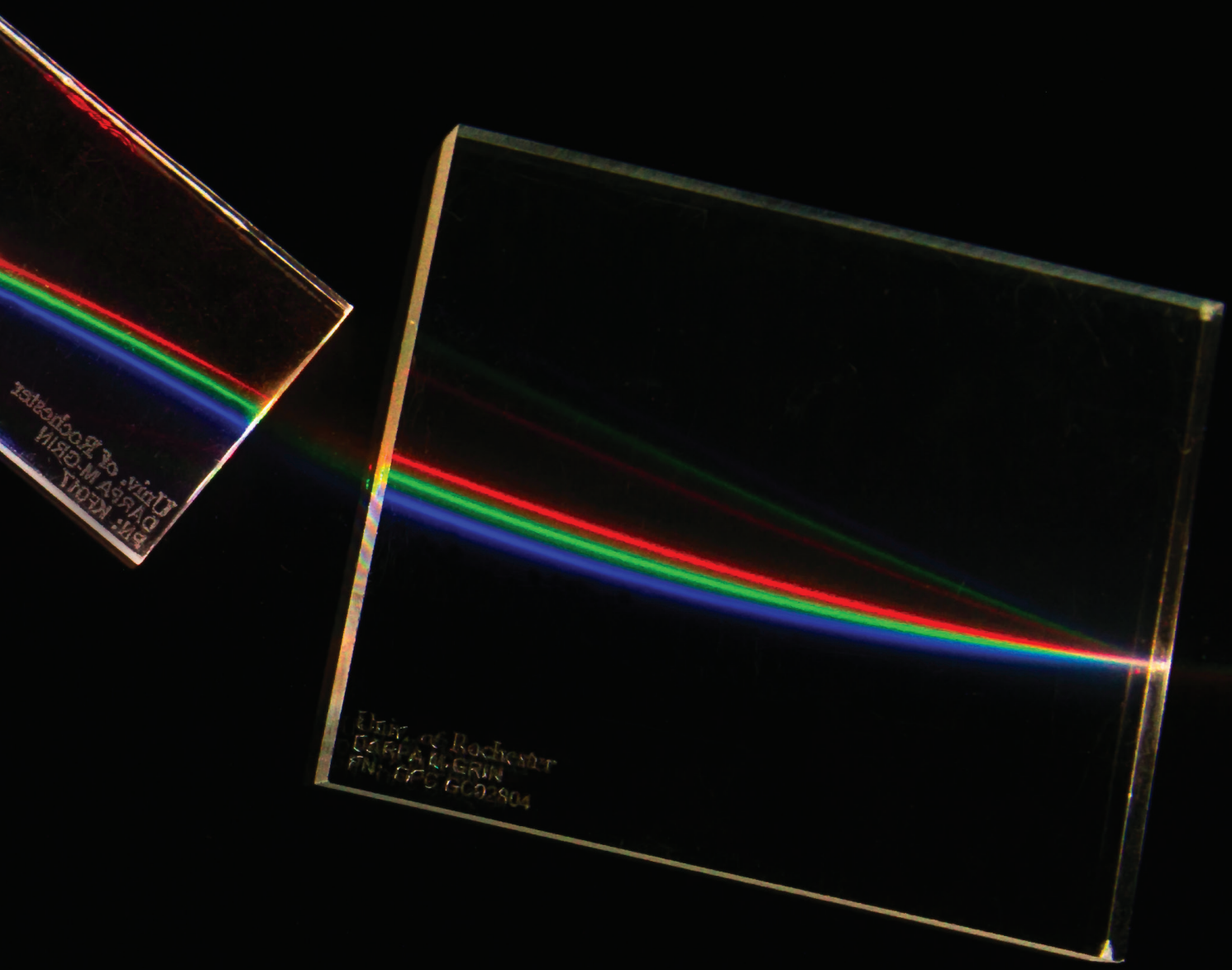
CEIS

CENTER FOR EMERGING AND INNOVATIVE SCIENCES



ANNUAL REPORT 2013–2014

Research + Industry = Transforming Technology

CEIS

Contents

NICK NAPOLITAN

MARK F. BOCKO

We are pleased to present this CEIS Annual Report for the fiscal year 2013–14. We provide our annual report to summarize the work of CEIS to grow the regional and state economies through industry-university collaborative research. We do this in several ways: by providing matching funds for on-campus university research sponsored by New York State companies, through outreach activities such as our annual University Technology Showcase, and more recently by building regional and national coalitions to undertake major economic development initiatives in our region with the support of the federal government. The primary funding source of CEIS is the New York State Division of Science, Technology, and Innovation (NYSTAR), now part of the NYS Department of Economic Development. In the past two years, we have broadened our source of funding to include multiple federal agencies.

In our annual review of economic impact from CAT-supported initiatives, 19 entities reported impact totaling more than $35 million in overall job and non-job categories, which included 21 new jobs and 40 retained positions. This economic impact is similar to what we were able to report last year, in spite of continued downsizing at some of the area's large employers. One of our key partners, Harris Corporation, led the way, reporting 4 new jobs, 12 retained jobs, and $20.8 million in non-job impacts. And we are especially pleased with the job impacts reported by two of our small company partners: Adarza BioSystems (9 retained jobs) and OptiPro Systems (8 new jobs). In addition to these direct financial impacts, CEIS-sponsored research resulted in 11 publications and the graduation of 13 master's and PhD students. Our funding has also helped produce 5 patents awarded to CEIS principal investigators. These are all very important ways that university research can have economic impact.

For the current year, CEIS is providing financial support to 11 principal investigators working with 8 different companies on 13 projects. Total funding for the 2013–14 year is projected to be $450,000. Our focus continues to be in the optics, photonics, and imaging areas, and we are continuing to court more small-to-medium-sized partners in keeping with the changes taking place in the region.

More recently we have expanded our scope and impact on the community through our work with the federal government. In 2012 we were awarded a grant from 5 different federal agencies to accelerate the growth of the local photonics cluster. And in May of this year we were awarded a grant from the National Institute for Standards and Technology to develop technology roadmaps for the U.S. photonics industry and to establish a consortium to work on manufacturing challenges to the industry. Also in May, the City of Rochester was designated as a Manufacturing Community by the government based on a proposal to the Investing in Manufacturing Communities Partnership, in which CEIS played a leading role. All of these programs are moving forward and already showing an impact on the community. While CEIS is continuing in its mission to bring together universities, companies, and economic development organizations to grow the regional economy, we also are serving as a catalyst for change in our community.

We would like to thank the staff at CEIS, including our business manager, Cathy Adams; our administrative assistant, Melissa Higgins; our recently recruited information analyst, Ana Garcia; and our student assistants, Nick Napolitan, Tergel Purevdorj, and Ervis Vukaj. We would also like to give a special thanks to adjunct professor Jay Eastman '70 '74 (PhD), who has volunteered a substantial amount of his time this past year at CEIS to work on economic development. And we acknowledge the continued support of NYSTAR, now a division of the New York State Department of Economic Development, and our federal partners—EDA/NIST/DOE/ETA/SBA for the Advanced Manufacturing Jobs and Innovation Accelerator Challenge and AMTech initiatives.

Mark F. Bocko, Director

Paul Ballentine, Executive Director

PARTNERS

CEIS recognizes the need and tremendous potential for the Rochester region to prosper and re-establish itself as the imaging capital of the world. We are committed to help lead this effort in collaboration with our equally committed academic, industry, and government partners.

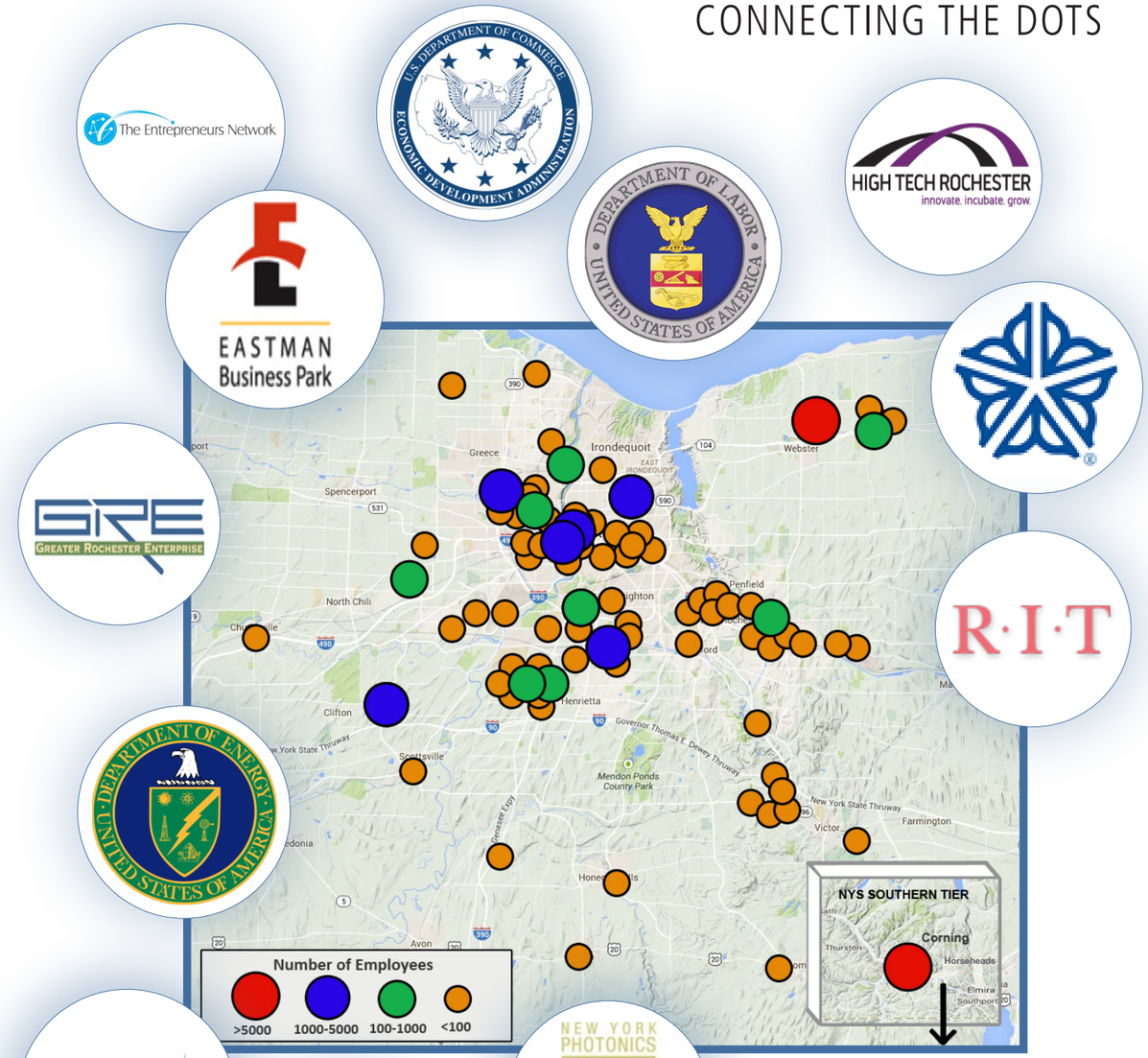
We are a research resource and partner to major global corporations and small startups—all with the purpose of developing and commercializing new technologies in New York State so that they can be brought to market in diverse applications while growing the regional economy.

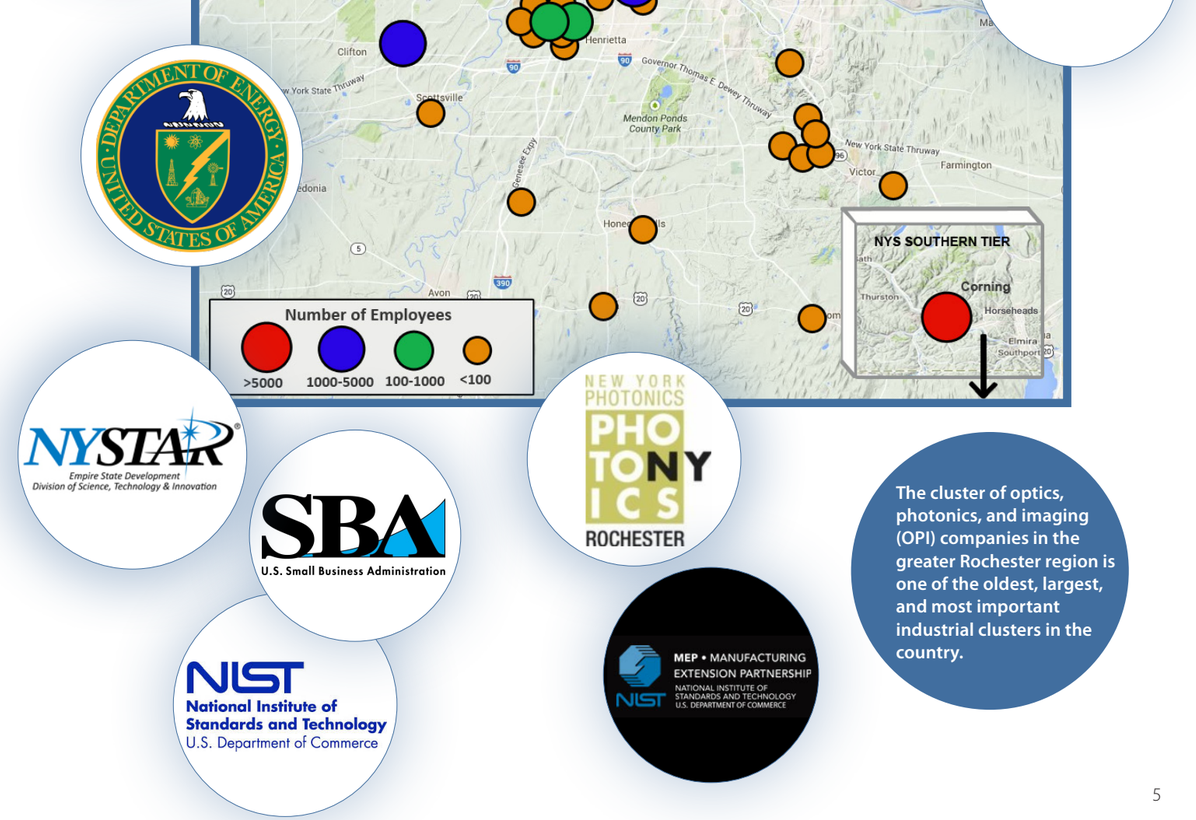
In total, more than 50 researchers covering a wide array of research interests are the principal investigators of CEIS. This annual report includes the following overview of their scientific passions, projects, and patents. We hope that reading about their accomplishments and capabilities will spark the potential for a new collaboration.

Contact us so that we can work with you to develop your company's next wave of products or services.

To explore research project opportunities, please contact
Paul Ballentine, *Executive Director, Business Development*
(585) 273-2642
paul.ballentine@rochester.edu

CONNECTING THE DOTS





The cluster of optics, photonics, and imaging (OPI) companies in the greater Rochester region is one of the oldest, largest, and most important industrial clusters in the country.

ECONOMIC IMPACT—FROM CEIS INNOVATIONS

For the fiscal year July 1, 2013, to June 30, 2014, the total documented dollar value of the economic impact due to the research CEIS helped support was more than $35 million. This impact, due to the value of new and retained jobs, increased sales, decreased costs, additional funding acquired and capital investment remains a good indicator of the region's economic health. The number of jobs (61) this research helped create or retain is on par with the five-year average. Approximately 64 percent of these jobs are with the small companies we work with; 76 percent of the newly created jobs were reported by these small companies. We believe this is the most important metric in the current economic environment of high unemployment.

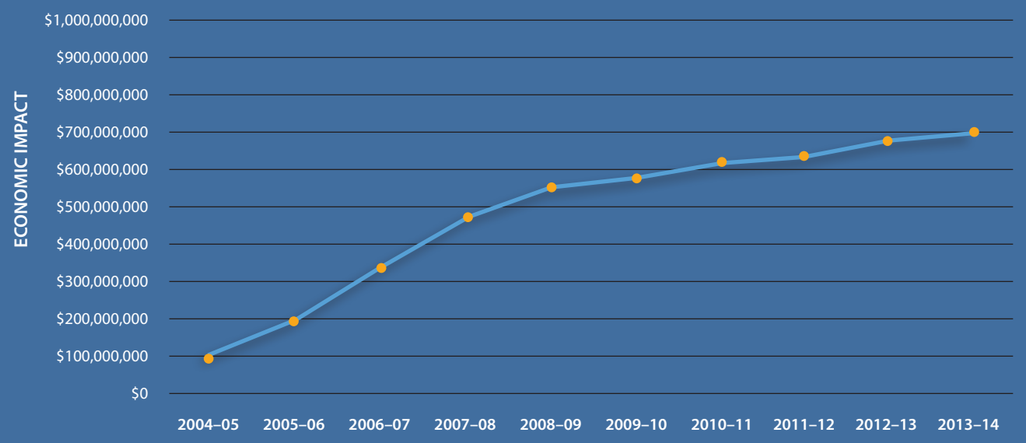
TEN-YEAR SUMMARY OF ECONOMIC IMPACT

Year	'04–'05	'05–'06	'06–'07	'07–'08	'08–'09	'09–'10	'10–'11	'11–'12	'12–'13	'13–'14	Total
Increased Revenues	$82,620,065	$105,271,000	$104,756,800	$107,723,300	$56,224,541	$7,244,229	$9,287,081	$7,493,412	$22,058,613	$20,816,657	$523,495,698
Cost Savings	$7,146,889	$6,390,386	$10,533,460	$9,543,230	$7,891,280	$5,933,200	$3,842,000	$3,444,000	$3,146,200	$6,276,553	$64,147,198
Funds Acquired	$410,000	$2,441,000	$7,002,500	$12,822,500	$4,752,700	$4,260,000	$11,801,946	$4,040,141	$7,380,774	$3,103,808	$58,015,369
Capital Improvements	$135,000	$92,500	$415,000	$94,000	$18,682,720	$518,235	$5,591,664	$176,000	$679,000	$792,806	$27,176,925
Job Value	$1,334,788	$361,331	$1,201,739	$4,352,632	$2,551,074	$3,022,380	$4,559,006	$3,015,652	$4,921,362	$4,245,605	$29,565,569
New Jobs	19	6	14.7	35	20.5	22.5	25.5	7.75	28.35	21	200
Retained Jobs	0	0	4.5	37	17	20.5	42.3	34.5	43	40	239
Total Impact	$91,646,742	$114,556,217	$123,909,499	$134,535,662	$90,102,315	$20,978,044	$35,081,697	$18,169,205	$38,185,949	$35,235,429	$702,400,759
Total Cumulative Impact	$91,646,742	$206,202,959	$330,112,458	$464,648,120	$554,750,435	$575,728,479	$610,810,176	$628,979,381	$667,165,330	$702,400,759	$702,400,759

COMPANIES REPORTING ECONOMIC IMPACT IN 2013–14 FROM CEIS INTERACTIONS

Adarza BioSystems, Inc.
Advanced Acoustical Imaging Technologies, LLC
AlchLight
Corning, Inc.
DichroTec Thin Films
Diffinity Genomics
Flint Creek Resources
FluxData
Harris Corporation
IBM
ITT Exelis
LighTopTech, Corp.
Optech, Inc.
OptiPro Systems, LLC
PL E-Communications, LLC
Robotic Therapeutic and Imaging, LLC
Thermo Fisher Scientific, Inc.
UCB Pharma
UR /AMTech

TEN-YEAR CUMULATIVE ECONOMIC IMPACT



SOCIAL MEDIA STATS

Over the past year CEIS has increased its online presence. As most people rely on the web for their news content, CEIS has launched a LinkedIn company page and Facebook page to share pertinent news in the optics, photonics, and imaging (OPI) space that it supports. These social media platforms provide places for discussion about news and changes in the Finger Lakes region and the OPI industry. These endeavors are in addition to the CEIS website, which remains a primary online communication source for broadcasting exciting news from our partners on a regular basis as we strive to highlight their accomplishments and engage with others in the OPI cluster.

Website Analytics for Past Year

Page Views: 20,327
Users: 4,098
Sessions: 6,062
New Visitor: 65.7%
Returning Visitor: 34.3%

Since June 2014

Since December 2013

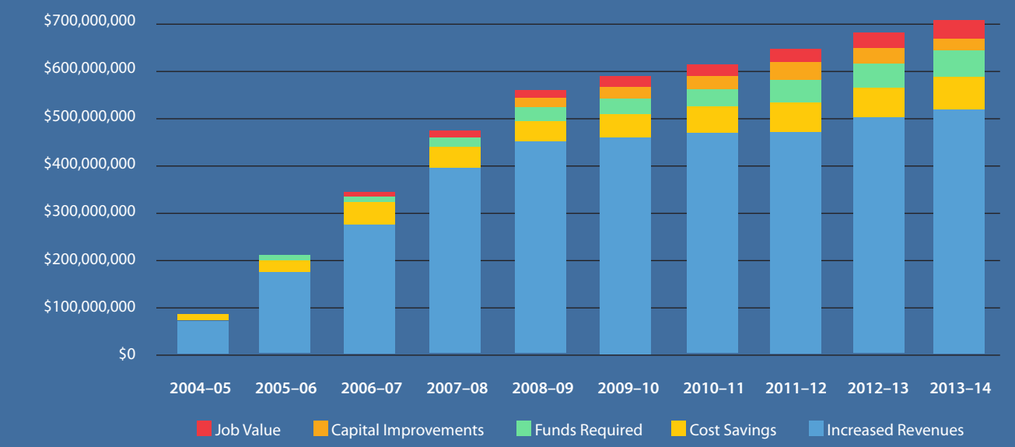
CAT PROGRAM FINANCIALS 2005–14

FUNDING FROM NYSTAR

Research Expenditures	$2,795,429
Operational Expenditures	$6,268,506
(Research and Center Related)	
Total NYSTAR Contribution	**$9,063,935**

OTHER SOURCES OF FUNDS	
Cash from Companies	$12,138,596
Other Sources of Funds	$1,444,717
Total Other Sources	**$13,583,313**

TEN–YEAR ECONOMIC IMPACT



FEDERAL INITIATIVES

In 2012, after 20 years of being funded solely by New York State, CEIS began to collaborate with the federal government on rebuilding the manufacturing sector of the Rochester region's economy. We are pleased to report we have been making rapid progress on this front. We began in June of 2012 when we applied for one of the Advanced Manufacturing Jobs and Innovation Accelerator Challenge (AMJIAC) awards. The purpose of the AMJIAC program is to strengthen regional manufacturing clusters. The program is funded by a pooling of resources from five different federal agencies: the Economic Development Agency, NIST, the Department of Energy, the Employee and Training Administration, and the Small Business Administration. AMJIAC is one of President Barack Obama's four major manufacturing jobs initiatives. In October 2012 we were pleased to learn we had been awarded one of only 10 AMJIAC grants given nationwide.

CEIS's AMJIAC program is called the Rochester Regional Photonics Accelerator (RRPA) program and is designed to strengthen the region's optics, photonics, and imaging (OPI) companies, with a special focus on the more than 50 small optics companies in the region. The RRPA is a three-year $2.6 million program that brings together five leading regional educational and economic development organizations: the University of Rochester, Rochester Institute of Technology, Monroe Community College, High Tech Rochester, and the Rochester Regional Photonics Cluster. The RRPA program also has support from NY State's Empire State Development–specifically the DOE, EDA, and NIST components. The RRPA forms a comprehensive and coordinated approach to promote development of the Rochester photonics cluster, business development at the member companies, technology development, and workforce development.

We have been making good progress on our effort to accelerate growth at the small optics companies. The EDA grant has enabled RRPC to expand its support activities for the cluster at domestic trade shows and, for the first time, represent the cluster at an overseas trade show. The ETA grant been used to provide scholarships to both unemployed and employed workers to continuing education classes in optics, photonics, and imaging. The DOE and NIST grants have been used to help small companies grow. And the SBA grant has helped support entrepreneurs and startup OPI companies such as LighTopTech, Inc. and Ovitz Corporation as well as Flint Creek Resources, which is developing a process to reclaim the cerium oxide used to polish optical components. The most important aspect of the RRPA program, however, is turning out to be the teamwork that it has fostered among the participating local organizations.

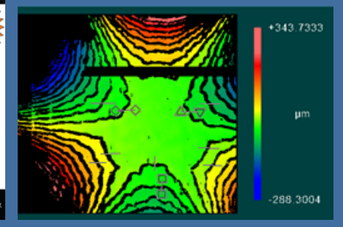
Our progress with the AMJIAC grant helped pave the way for the next important collaboration with the federal government. In October 2013 we applied for a second manufacturing jobs grant—the NIST Advanced Manufacturing Consortia (AMTech) program. The purpose of the AMTech program is to establish and strengthen U.S. consortia that are focused on developing advanced manufacturing technologies. In May 2014 we were pleased to learn our proposal was one of 18 selected nationally. In fact, the CEIS proposal was rated at the top of the 84 proposals received by NIST.

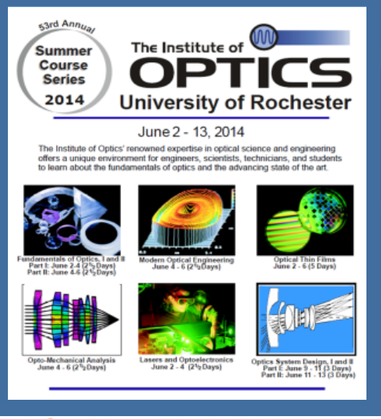
CEIS's AMTech proposal, named the National Technology Roadmap for Photonics (NTRP), has three components. The first is to develop a set of roadmaps for the U.S. photonics industry. The technologies we are roadmapping are advanced optics, lasers, imaging and sensing systems, displays, and biophotonics. A key purpose of the roadmaps is to identify manufacturing challenges that are suitable for being addressed by a public-private partnership. The second component is to put together a consortium that would address these challenges. The plan is to have this consortium apply for another one of the President's jobs initiatives – the National Network for Manufacturing Innovation (NNMI). The third component of the NTRP program is to develop a strategy to expand photonics manufacturing in New York State. This strategy would build off of the first two components and leverage the vast resources the Rochester region has in optics, photonics, and imaging. These assets include a talented workforce, leading educational and research institutions, a large industrial cluster, and a substantial manufacturing support infrastructure.

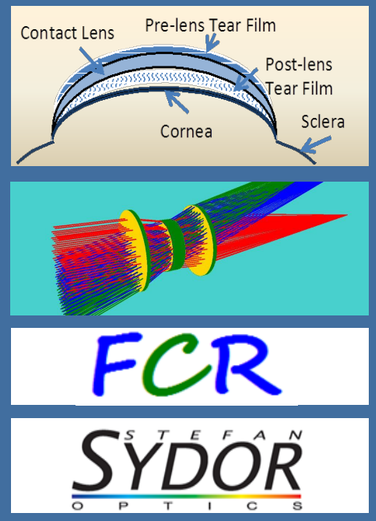
In April 2014 CEIS collaborated with the City of Rochester to apply for the third of the president's four manufacturing jobs programs. This program, called Investing in Manufacturing Communities Partnership, gives communities preferred status on $1.3 billion in federal economic aid from nine different federal agencies. In May 2014, just two weeks after being notified of the AMTech grant, the city was informed that it had been designated as one of only 12 "manufacturing communities" in the United States. The application covers the nine-county Finger Lakes economic development region of New York State and is focused on two industries: photonics and advanced manufacturing. For any one region to have won three out of the president's four major manufacturing jobs initiatives is unprecedented. It is a reflection of the important role that manufacturing in Rochester, and photonics manufacturing in particular, plays in the nation's economy. And it helps demonstrate the leadership CEIS is providing in revitalizing the region's economy.

CEIS continues to act as a catalyst for regional economic development by leading the effort to bring the fourth major manufacturing jobs programs to Rochester—the National Network for Manufacturing Innovation (NNMI) program. The NNMI program is modeled off of the Fraunhofer Institutes in Germany and calls for the establishment of as many as 40 Institutes for Manufacturing Innovation (IMI). Each IMI will be regionally based and focus on a different manufacturing technology. Federal funding for each institute ranges from $70 million to $120 million over a five- to seven-year period. In October 2014 the president announced that the Department of Defense will fund an IMI for integrated photonics. CEIS is now playing a leading role nationally by working with companies and universities to establish an IMI for integrated photonics. We expect the proposals will be due early next year, and announcements will be made by the middle of the year.

The progress we are making with the help of both our state and federal partners further strengthens our mission here at CEIS: Research + Industry = Transforming Technology.







Rochester hosts Optifab, the largest optical manufacturing exhibition in North America.

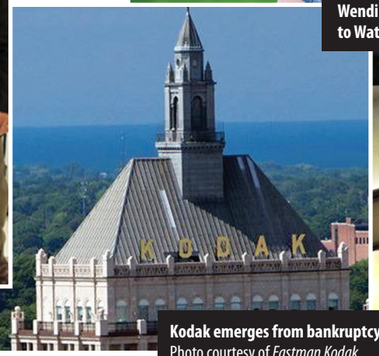
2013 Optifab

Congresswoman Louise Slaughter visits Exelis

FUZEHUB

▲ Gov. Andrew Cuomo announces the FuzeHub initiative.

Wendi Heinzelman featured as a Woman to Watch in the *Democrat and Chronicle*.



Kodak emerges from bankruptcy
Photo courtesy of *Eastman Kodak*

CEIS hosts its annual Technology Showcase.

◄
The RRPC banner representing New York State at Photonics West.

A coalition troop using his Harris tactical radio.
Photo courtesy of *Democrat and Chronicle*

United Nations declares 2015 as the International Year of Light. ►

◄
Moondog Labs, which was founded by a CEIS Advisory Board member Julie Gerstenberger, has developed an anamorphic lens that allows for panoramic videos and pictures to be taken.

Ovitz, a start-up out of the University of Rochester, wins the Rochester Regional Business Plan competition.

Aug. 14, 2013
Rep. Louis Slaughter, Exelis announce $2 million technology partnership with University of Rochester that will support local jobs in advanced manufacturing

Sept. 3, 2013
Kodak emerges from bankruptcy

Sept. 5, 2013
Executive Director Paul Ballentine receives RRPC Leadership Award

Sept. 25, 2013
Wendi Heinzelman, prominent CEIS CIR awardee featured as Woman to Watch

Oct. 20, 2013
Rochester hosts the SPIE Optifab meeting—North America's largest exhibition of optical manufacturing and testing equipment and technology

Nov. 14, 2013
Governor Andrew Cuomo announces Fuzehub Initiative to help manufacturing companies grow their business

Dec. 23, 2013
The United Nations General Assembly proclaims 2015 as the International Year of Light and Light-based Technologies

Jan. 10, 2014
Harris Corporation, CEIS Awardee receives $18 million in orders for tactical radios from U.S. Special Operations Command

April 10, 2014
CEIS hosts Annual Technology Showcase at Eastman Business Park

April 16, 2014
U.S. Senators Chuck Schumer and Kirsten Gillibrand submit joint statement to Commerce Secretary Penny Pritzker in support of IMCP Designation for Rochester and Finger Lakes region

May 8, 2014
CEIS Awarded Dept. of Commerce/ NIST AMTech grant ($500,000) to fund National Photonics Roadmap

May 28, 2014
Rochester receives IMCP "manufacturing community" Designation giving the area a leg up on $1.3 billion in manufacturing funds

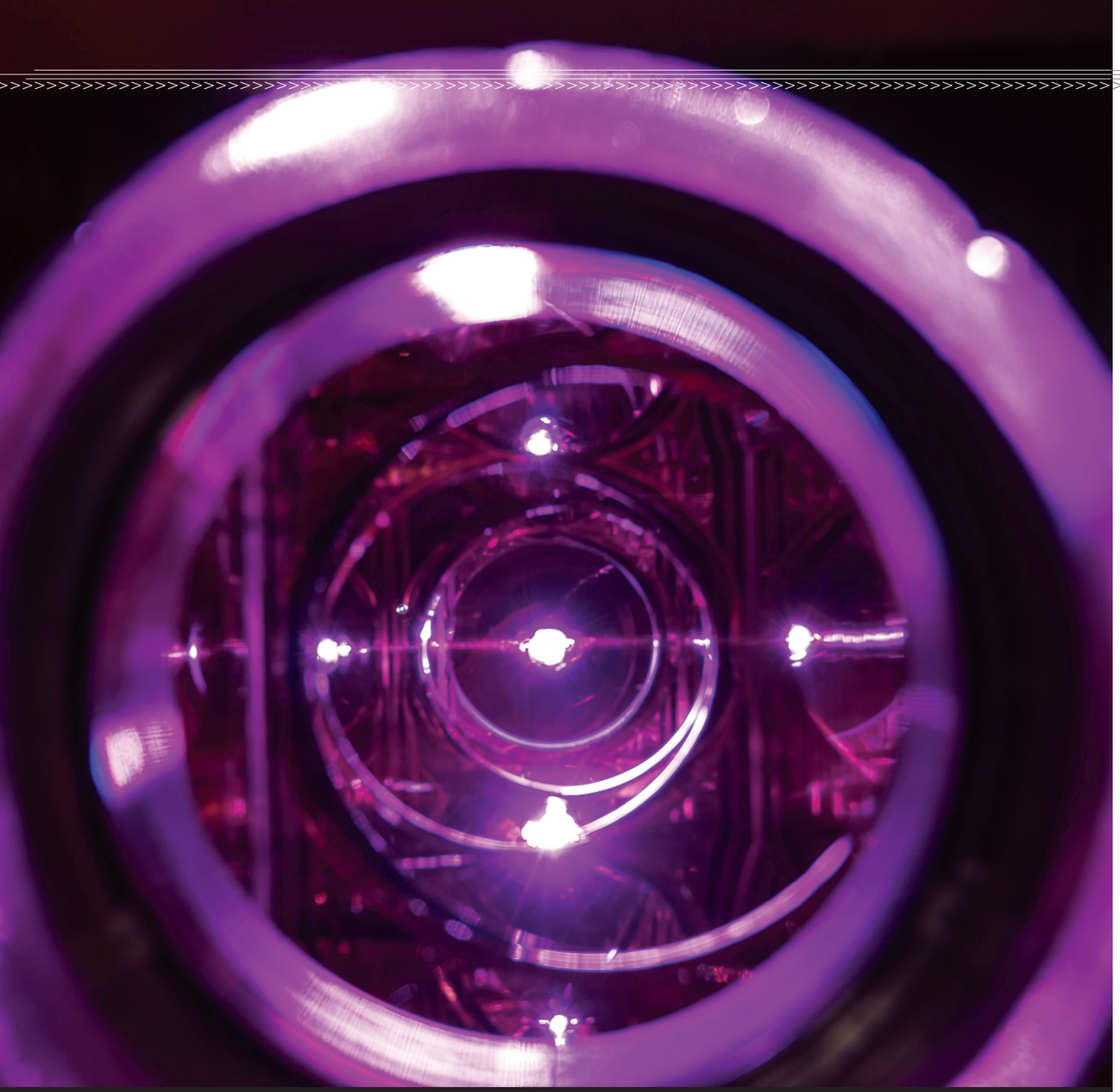
June 3, 2014
Department of Defense issues a request for information from academia and industry seeking to be the site of an optics/photonics manufacturing institute

June 23, 2014
CEIS announces CIR awards for 13 projects with 11 faculty researchers and 8 New York companies

June 26–27, 2014
RRPA partners attend Grantee (JIAC, RJA, AMJIAC, MIIA) Regional Collaboration Meeting at NIST

June 30, 2014
To date, 71 scholarships have been awarded to individuals through the RRPA program with one-third being underemployed or unemployed

YEAR IN REVIEW



2014–2015

ABSTRACTS

Development of Glass Panel Distributed Mode Loudspeakers
Mark Bocko
University of Rochester
Corning, Inc.

This proposal is for a continuation of a project sponsored by Corning Inc. to develop glass panel "distributed mode loudspeakers." Work will continue in several areas in the coming year. Specifically, we are building a variable-temperature cryostat to enable temperature-dependent measurement of the mechanical internal friction of various glass samples from which the activation energy of the internal loss mechanisms may be inferred. The ill effects of bending wave frequency dispersion to the sound quality of glass DMLs is now well understood and it has been demonstrated that a MIMO (multiple input multiple output) method may be employed to compensate. Experimental studies of this will continue. And, finally, to enable spatial control of radiated sound we are developing methods for the distributed drive and control of glass panels employing an array of transparent piezoelectric drivers laminated to a glass panel.

Polycrystalline Silicon and Metal Oxide Thin Film Transistor (TFT) Development
Karl Hirschman
Rochester Institute of Technology
Corning, Inc.

This project is a continued study of LTPS and metal-oxide (IGZO) TFT processes and devices at Rochester Institute of Technology (RIT). Baseline processes have been developed for thin-film transistor fabrication. The goals of this work are to investigate passivation materials and process integration techniques and device structures for improved IGZO TFT performance; investigate the use of Xe flash-lamp annealing along with other techniques for the crystallization of a-Si and investigate the influence of alternative glass formulations on the electrical characteristics of fabricated devices. Glass substrates will be prepared by Corning Inc. Device fabrication will be done at the Semiconductor & Microsystems Fabrication Laboratory (SMFL) at RIT, with certain thin-film deposition processes and treatments performed at the Corning clean room facility. This proposal presents a plan of work to fabricate and characterize thin-film transistors on glass substrates.

Further Development of THz Imager Array in Support of ITT Exelis' Commercial THz Development
Zeljko Ignjatovic
University of Rochester
Exelis

This project proposes to conduct a variety of THz measurements, parameter characterization, and develop design methodologies for THz focal plane arrays in standard CMOS technologies in support of ITT Exelis' THz initiative. The proposed work is a continuation of our current efforts with ITT. During the 2014–15 academic year, we will begin tests on the THz test imagers fabricated in 2013–14. The results of this analysis will be used to model the THz response of standard MOSFETs and design an optimal THz focal plane array, which will be fabricated and tested subsequently.

Further THz Array Development and Characterization
Judith Pipher and Craig McMurtry
University of Rochester
Exelis

Design, build, and characterize a THz detector array that operates at room temperature or if cooled only slightly. Test arrays on a chip will be characterized in our lab using the University of Rochester array controller, and test structures will be characterized independently in RIT and University of Rochester engineering labs. First results obtained with single pixels on the last designs have been very promising and have driven this year's design and project directions. A newly designed chip is being submitted for manufacture at the end of May 2014 for delivery about three months later. Once our team receives final information from the design team on the pin-outs, the biases, and the clocking, appropriate interface boards to our system and new clocks for the array controller will be designed and constructed. While we do not need to cool the array to cryogenic temperatures, we use our dewar with an ultra-pure Si window as the mounting platform because it acts as a Faraday Cage and has suitable interface to the array controller. If noise turns out to be a limiting factor in operation, we will cool the array to determine the temperature required to reduce thermally generated noise.

THz Modeling and Testing
Zoran Ninkov
Rochester Institute of Technology
Exelis

A group consisting of Exelis engineers, RIT scientists, and University of Rochester engineers and scientists has designed and manufactured a first-generation room-temperature silicon imager, to be operated in plasmonic mode at THz frequencies. There are several pixel varieties that have been tested with varying design dimensions, including with and without antennas. The RIT group from the Chester F. Carlson Center for Imaging Science has developed a testing system for terahertz single pixel characterization. This effort will determine the ideal pixel structure and configuration for optimal responsivity, allowing the imaging array design to move forward. A custom low-noise enclosure and cabling setup, along with a source measurement unit perform MOSFET voltage and current sweeps for transconductance, channel conductance, and resistance measurements and terahertz radiation responsivity. A 188-GHz Gunn diode is the current primary radiation source under test, with plans to move toward a tunable source with multiple bands from 0.1 to 1.0 terahertz. Results of these tests have provided input for next-generation design. This year we plan to produce a THz Imaging Prototype System that can be used by Exelis for future product development.

Laser Polishing for Additive Manufacturing
Jie Qiao
Rochester Institute of Technology
Harbec

Additive manufacturing technology allows for direct, cost-efficient manufacturing of high-quality metal tool inserts, prototypes, and end products. However, the current final finishing of additively manufactured metal parts is not satisfactory, especially for freeform products. Hand polishing is a required post-processing step, which is lengthy and costly, therefore cancelling out the net benefit of additive manufacturing. This project will develop a short-pulse-laser–based polishing technology to improve surface-finishing quality, increase flexibility, and decrease lead time. This is a partnership with a New York State innovative tooling, machining, prototype development, molding, and production company, synergizing state-of-the-art additive manufacturing and laser polishing technologies.

Support for Distributed Computing and Network Management in Mobile Ad Hoc Networks
Wendi Heinzelman
University of Rochester
Harris Corporation

Performing communication and computation in an ad hoc network of mobile devices is challenging yet critical for next-generation military networks. Not only must we ensure that data can be communicated where it is needed, when it is needed, we must also ensure that heavy computation can be accomplished quickly using available resources within the network. To address these issues, we will 1) extend our current distributed computing system to support multi-hop routing of tasks and results, and 2) determine how best to monitor available resources, including communication, computation, energy, and connectivity for devices in the ad hoc network. The eventual goal is to support robust communication and efficient task distribution in an ad hoc network environment.

Femtosecond Laser Blackening Pt/Rh Alloy for Space Cooling Applications
Chunlei Guo
University of Rochester
Moog-ISP

A spacecraft, such as a satellite, requires a propulsion system to accurately control its position and motion. The lifespan of satellites is essentially over once their propulsion system ceases to function. This limited lifespan of the propulsion system is mainly due to the nozzle degradation from severe heat during propulsion. If the nozzle temperature can be lowered during propulsion, the lifespan of the spacecraft/satellites will prolong significantly. In collaborating with Moog-ISP, we plan to create a highly absorptive and highly radiative metal used for nozzles. The lifespan of the nozzle made from this material is expected to prolong significantly.

Development and Investigation of an Integrated Laser-based Optics Polishing / Manufacturing Technology
Jie Qiao
Rochester Institute of Technology
OptiPro

This project develops a short-pulse-laser–based advanced optics or metal manufacturing technology to overcome the limitation of conventional polishing technologies such as long processing time and polishing waste and high cost for manufacturing aspheric and freeform optics. This is a partnership with a world-leader manufacturer of high-precision optical polishing equipment. This project will design and integrate a beam-shaping component with a laser polishing system to decrease the surface roughness induced by the conventional Gaussian beam profile. Increased flexibility, decreased lead time, and potential to remove mid-spatial-frequency ripples caused by standard polishing techniques will be investigated.

Enhancing the UV/VUV Sensitivity of CMOS Image Sensors
Zoran Ninkov
Rochester Institute of Technology
Thermo Fisher Scientific

This project continues our effort to improve the U/VUV sensitivity of CMOS image sensors by coating the arrays with quantum dots (QD). This year's work will proceed with detailed testing of the devices that are now routinely coated with QD. In order for Thermo Fisher to proceed with the plans for commercialization, two key measurements are required. These tests are (a) radiation testing of the CMOS and (b) deep UV/VUV absolute sensitivity measurements. If these two tests are positive, these devices would see widespread application in the markets served by Thermo Fisher Scientific—namely UV/VUV spectroscopy and radiation hard applications. We will be conducting the two tests at (a) the NIST SURF III Cyclotron Facility in Gaithersburg, Md., and (b) the 88" Cyclotron at Lawrence Berkeley National Laboratory in California.

Wine Recommendations for Grocery Shoppers
Jiebo Luo
University of Rochester
Wegmans Food Market

Wegmans Food Markets maintains a Shopper's Club and keeps a record of each member's shopping history. There is interest in utilizing this big data to increase wine sales in Century Liquor & Wine stores that Wegmans also owns throughout the Northeast. In this project, we investigate customer clustering, collaborative filtering, and content filtering to build a prototype recommender system that can generate a high customer response.

Non-Contact Video-based Detector of Cardiac Arrhythmias: A Proof-of-Concept Study
Jean-Philippe Couderc and Michael Huang
University of Rochester
Xerox Corporation

We propose to investigate whether new contactless video-based monitoring technology is valuable to monitor patients with an increased risk for life-threatening arrhythmias. The proposed project aims to get insights into the interest of using facial video-plethysmography (VPG) signals to monitor the electrical state of a patient's heart. Our working hypothesis is: the short occurrence of cardiac arrhythmia could be associated with specific and detectable facial VPG patterns that could ultimately be used to identify patients with an increased risk for life-threatening arrhythmias.

Fine-Grained User Profiling from Multiple Social Multimedia Platforms
Jiebo Luo
University of Rochester
Xerox Corporation

Increasingly rich and large-scale social multimedia data (including text, images, audio, and video) are being generated and posted to social networking and media sharing websites. A user's sharing and posting behavior in social media can reveal a variety of useful information about the user, and, hence, user profiling and demographics analysis from social media have attracted the attention of both academia and industry. In this project, we propose to analyze social media data from multiple social media platforms and build comprehensive user profiles by integrating information retrieved from multiple social media platforms.

2013–2014

ABSTRACTS

The AIR Flu Chip: A Multiplex Optical Biosensor for Influenza Serology
Benjamin L. Miller
University of Rochester
Adarza BioSystems, Inc.

There is an urgent global need for better tools for influenza surveillance, diagnosis, and vaccine development. Current laboratory methods for influenza serology have changed little in decades and are notable primarily for their complexity and requirement for highly regulated laboratory environments. Building on preliminary results from our group, we propose to develop a new optical biosensor chip on the Arrayed Imaging Reflectometry (AIR) platform, a sensitive label-free multiplex sensing technology, that will allow for the simultaneous detection and quantification of panels of influenza antibodies in human and animal serum.

Superwicking Cooling Devices for Computer CPU and Microelectronics
Chunlei Guo
University of Rochester
AlchLight

Currently, heat flux at both the chip and module levels of packaging in computers can be so high (200–1000 W/cm2) that it exceeds the practical limit of traditional air cooling. To combat this problem, liquid cooling is now being actively pursued. Recently, we developed a laser surface processing technique that turns a regular material surface superwicking. The structured surfaces exhibit a superwicking effect that can draw liquid vertically uphill against gravity. In this project, we plan to characterize the cooling performance of the superwicking surface and eventually integrate it to a heat pipe or heat sink device for cooling computer CPUs and other high-heat-flux electronic devices.

Ocular Surface Metrology and Inflammatory Mediator Response to Topical Administration of Anti-inflammatory Drug
James V. Aquavella, Geunyoung Yoon, James Zavislan, and Richard Phipps
University of Rochester
Bausch + Lomb

Ocular surface metrology obtained in noninvasive and objective fashion in a controlled environment can be utilized in contribution with identification of surface inflammatory mediators to access the efficacy of topically applied anti-inflammatory drugs utilized to treat dry eye syndrome. This combined application of environmental stress to increase evaporation will improve our ability to access the potential efficacy of new drugs and therapies.

Optomechanical Scanners for Femtosecond Micromachining
Jonathan D. Ellis and Wayne Knox
University of Rochester
Bausch + Lomb

This project's long-term goal is to use femtosecond micromachining to customize refractive corrections in human eyes, be it in the cornea, contact lenses, or implanted IOLs. This requires high numerical aperture (NA) lenses (>0.6), placing severe limits on optical scanning. To achieve high throughput either for manufacturing or clinical applications, scan speed during lasering must exceed 500 mm/s over scan areas greater than 5 mm. Our goal is to develop an optical scanner capable of micromachining with high NA lenses in <5 min. over a large area and with intensity modulation. These properties together are necessary for writing customized corrective structures for ophthalmic applications.

Femtosecond Laser Intra-tissue Refractive Index Shaping (IRIS) in Living Cornea
Krystel Huxlin and Wayne Knox
University of Rochester
Bausch + Lomb

This project's long-term goal is to use femtosecond micromachining as a nondamaging method of customizing the refractive correction in a human eye. The proposed experiments focus on corneal applications of this technology to: (1) assess the feasibility of inscribing a 1.0D spherical lens into the cornea of a living cat over a 3 mm diameter area; (2) assess the feasibility of inscribing high-quality refractive structures into the living cornea over a 5 mm diameter area; (3) assess the longevity of inscribed patterns up to 12 months using wavefront, and (4) assess biological impact and safety post-IRIS in cat and human corneas.

Femtosecond Micromachining of Hydrogels
Wayne Knox
University of Rochester
Bausch + Lomb

This project's long-term goal is to use femtosecond micromachining as a method of customizing the refractive correction in a human eye, be it in the cornea, lens or implanted IOLs. The proposed experiments use a femtosecond laser to write different kinds of refractive correctors with principal goals to (1) optimize materials and find the best two-photon sensitizers and writing conditions, (2) write and directly measure wavefront quality, optical scattering, and other characteristics of refractive correctors using our newly developed shaker-type scanner system, and (3) implement intensity control using new acousto-optic modulators and develop a systematic design methodology for writing of refractive correctors that can be applied to ophthalmic materials, ocular tissues, and, ultimately, in live eyes.

Enhancing Neural Function of Presbyopia by Improved Optics and Visual Training
Geunyoung Yoon
University of Rochester
Bausch + Lomb

Perceptual learning refers to vision training that increases the gain of neuronal signals, thereby improving visual performance and has been shown to be effective especially in subjects with amblyopia, 'lazy eye.' We propose to apply visual training protocol to presbyopia, age-related loss of near visual quality, to examine whether the visual system of presbyopia is sufficiently plastic to enhance neural function through the visual training, resulting in improving visual performance at both distant and near object distances. We will also test the hypothesis that the visual training combined with improved through focus optics of the eye stimulates neural plasticity more efficiently compared to normal presbyopic optics. We will use binocular adaptive optics vision simulator and computer-generated psychophysical visual tasks including both contrast threshold and resolution.

Handheld Enhanced Reflectance Confocal Microscopy for Neuropathy Screening
James Zavislan
University of Rochester
Caliber Imaging and Diagnostics

Reflectance confocal microscopy (RCM) is an FDA-cleared clinical imaging modality capable of performing a noninvasive optical biopsy. Dr. Zavislan has developed optical enhancements to RCM that increase the image fidelity of reflectance in vivo imaging by reducing speckle artifact by more than 10X as well as enabling an imaging mode that objectively measures the polarization properties of the tissue. This project works with Caliber Imaging and Diagnostics, which has licensed the patents covering this technology to implement this imaging mode in its VS-3000 handheld RCM to enable screening and monitoring of peripheral neuropathy affecting more than 13 million people in the United States.

Development of Glass Panel Distributed Mode Loudspeakers
Mark F. Bocko
University of Rochester
Corning, Inc.

This proposal is for a continuation of a project sponsored by Corning Inc. to explore the feasibility of employing glass panels as "distributed mode loudspeakers." In the first year of the project we explored the effect of the material properties of various glass compositions on loudspeaker performance. The ideal loudspeaker has a flat frequency response over the audio spectrum: 20 Hz to 20 kHz. To achieve this there must not be any strong, under-damped transverse mechanical modes of vibration in the panel, thus the primary material parameter affecting loudspeaker frequency response and, thereby, sound quality is the glass internal friction. Specifically, it is important that the sound radiating transverse modes of vibration of a glass panel demonstrate high damping, which leads to a loudspeaker characteristic that is closer to the ideal "flat" frequency response. The mechanical losses of several different glass compositions were measured, and it was determined that Gorilla glass displays the highest degree of internal friction of the samples tested. In the continuation of this project we will employ a newly acquired scanning laser vibrometer to correlate the measured frequency response, audio quality, and the vibrational mode structure of glass distributed mode loudspeakers to identify optimal panel mounting and excitation methods. A 2-D transmission line model for the distributed mode loudspeaker also will be developed in the second year of this project.

Polycrystalline Silicon and Metal Oxide Thin Film Transistor (TFT) Development
Karl D. Hirschman
Rochester Institute of Technology
Corning, Inc.

This project is a continued study of LTPS and metal-oxide TFT processes and devices at Rochester Institute of Technology (RIT). Baseline processes have been developed for thin-film transistor fabrication. The goals of this work are:

- improve upon shortened-cycle TFT processes that demonstrate reproducible results
- investigate alternative processing techniques and device structures for improved TFT performance
- investigate the influence of alternative glass formulations on the electrical characteristics of fabricated devices

Glass substrates will be prepared by Corning Incorporated. Device fabrication will be done at the Semiconductor & Microsystems Fabrication Laboratory (SMFL) at RIT, with certain thin-film deposition processes and treatments performed at the Corning clean room facility. This proposal presents a plan of work to fabricate and characterize thin film transistors on LTPS substrates.

Small Fragment Removal for Next Generation Sequencing
Lewis Rothberg
University of Rochester
Diffinity Genomics

Diffinity Genomics sells DNA purification kits using chromatographic materials that retain the desired nucleic acids confined in functional pipette tips. The original materials developed at the University of Rochester selectively adsorb unwanted nucleotides and primers while leaving the desired double-stranded DNA in solution. The present project aims to develop material that uses a different pore size and coating strategy, enabling it to sequester DNA fragments of size as large as 150 base pairs that could be used as part of next generation sequencing protocols.

Further Development and Test of THz Imager Array in Support of Exelis's Commercial THz Development
Zeljko Ignjatovic
University of Rochester
Exelis

This project proposes to conduct a variety of THz measurements, parameter characterization, and develop design methodologies for THz focal plane arrays in standard CMOS technologies in support of Exelis's THz initiative. The proposed work is a continuation of our current efforts with Exelis. During the 2013–14 academic year, we will begin tests on the THz test imagers fabricated in 2012–13. The results of this analysis will be used to model the THz response of standard MOSFETs and design an optimal THz focal plane array, which will be fabricated and tested subsequently.

THz Virtual Scene Generation and THz Antenna Modeling
Zoran Ninkov
Rochester Institute of Technology
Exelis

This project looks to expand the virtual scene generation capabilities of the software modeling package DIRSIG into the THz spectral region. This work will complement the efforts at the University of Rochester in developing THz detectors and utilize the THz infrastructure bought to the university's Institute of Optics by its new director, Xi-Cheng Zhang. In addition, at RIT we will continue to model the performance of THz antenna arrays built in the microelectronics facility here and tested in the THz calibration laboratory. The goal of the two projects are: (a) to produce realistic THz images and videos of scenes and (b) to produce optimum antenna designs for hybridizing to focal plane arrays being developed by the remaining team at the University of Rochester (Pipher, McMurtry, Ignjatovic, and Bocko).

Further Development and Test of THz Plasmonic Imager in Support of Exelis's Commercial THz Development
Judith. L. Pipher and Craig McMurtry
University of Rochester
Exelis

This project proposes to conduct a variety of THz measurements in support of Exelis's THz initiative. These build on our current work with Exelis in collaboration with RIT and with Professor Zhang's group and Professors Bocko and Ignjatovic's engineering faculty. During the 2012–13 academic year, we have measured THz performance of a silicon readout integrated circuit and participated in design discussions of a new THz imager. At the end of April, we will begin test and analysis of results on 252 variations, which will be fed into the next design phase and subsequent test and analysis.

Experimental and Programmatic Support for THz Focal Plane Array Development
Xi-Cheng Zhang
University of Rochester
Exelis

A group consisting of Exelis engineers, RIT scientists, and University of Rochester engineers and scientists are designing, manufacturing, and testing a room-temperature silicon imager to be operated in plasmonic mode at THz frequencies. Several pixel varieties will be designed and tested with and without antennas.

Sonoelastography to Measure Intrahepatic Fat
Christopher Barry and Kevin Parker
University of Rochester
GE Global Research

This project proposes an innovative and low-cost noninvasive method to accurately measure intrahepatic fat content, which could be used for both screening and therapy. "Sonoelastography" builds on the well-described principles of elastography, which has been used to quantitate liver stiffness and employs additional calculations to simultaneously measure steatosis as well as fibrosis. This tool would have a profound impact on the practice of medicine, since it would allow cost-effective, real-time, and accurate diagnosis and surveillance of patients suffering from the entire spectrum of fatty liver disease.

Support for Distributed Computing and Network Management in Mobile Ad Hoc Networks Using a Cloudlet Approach
Wendi Heinzelman
University of Rochester
Harris Corporation

Performing communication and computation in an ad hoc network of mobile devices is challenging yet critical for next-generation military networks. Not only must we ensure that data can be communicated where it is needed, when it is needed, we must ensure that heavy computation can be accomplished quickly using available resources in the network and at the network edge, rather than relying on external computing resources that may not be readily available in the battlefield environment. To address these issues, the goals for this project include exploring in a mobile ad hoc network setting: 1) the use of distributed cloud computing via a framework called GEMCloud that uses mobiles themselves as the cloud resources, and 2) approaches for network monitoring and management to support network operations and optimal task allocation for the GEMCloud distributed computing system.

Structured Light-based Microscope for Deep Sub-Wavelength Imaging
Thomas Brown, Jonathan D. Ellis, and Miguel Alonso
University of Rochester
IBM

The semiconductor industry is the gold standard for scalability in nanoscience. Since one defect sends an entire chip to the recycle bin, rapid nanometer scale metrology becomes essential. Many metrology tools exist for the nanoscale, including electron microscopy and atomic force microscopy. However, for manufacturing, nothing quite beats light-based techniques for speed and accuracy. The near-future projections for geometrical scaling of advanced semiconductor technology is making it progressively more difficult for optical metrology systems to generate information from which meaningful process control parameters can be extracted. These require techniques that deduce spatial information from samples well beyond the diffraction limit.

Gabor-domain Optical Coherence Microscopy for Detection of Defects in Manufacturing
Jannick Rolland
University of Rochester
LighTopTech Corporation

This Small Business Technology Transfer Phase I project will explore the applicability of a Gabordomain optical coherence microscopy (GD-OCM) instrument to qualify materials during manufacturing processes. The primary objective of this effort will be the demonstration of a robust and accurate GDOCM instrument for use in subsurface imaging and detection of defects in manufactured materials. The research will address the need for a rapid and robust scanning mechanism, compactly integrated within the optical microscope, to sample three-dimensional volumes and quantify undesired defects and imperfections introduced during the manufacturing of materials.

Structured Polarization States for Deep Sub-Wavelength Imaging
Miguel Alonso, Thomas Brown, and Jonathan D. Ellis
University of Rochester
IBM

The semiconductor industry is the gold standard for scalability in nanoscience. Since one defect sends an entire chip to the recycle bin, rapid nanometer scale metrology becomes essential. Many metrology tools exist for the nanoscale, including electron microscopy and atomic force microscopy. However, for manufacturing, nothing quite beats light-based techniques for speed and accuracy. The near-future projections for geometrical scaling of advanced semiconductor technology is making it progressively more difficult for optical metrology systems to generate information from which meaningful process control parameters can be extracted. These require techniques that deduce spatial information from samples well beyond the diffraction limit.

Optical Probing for Freeform Optics Metrology
Jonathan D. Ellis and Paul Funkenbusch
University of Rochester
OptiPro Systems, LLC

One of the limiting technologies for OptiPro's UltraSurf platform, a 5-axis coordinate measuring machine, is the optical probe used to measure the optical surface. Current probing technologies have limited range, resolution, and bandwidth. We propose building a fiber coupled optical probe that uses a simple LED or laser diode source with a completely passive architecture to measure surface topography and local slope as the probe is rastered across the part. This could potentially lead to OptiPro's own optical probing system rather than incorporating systems from other manufacturers. The goal for the project is to build a demonstration system and validate its performance on the UltraSurf.

Enhancing the UV/VUV Sensitivity of CMOS Image Sensors
Zoran Ninkov
Rochester Institute of Technology
Thermo Fisher Scientific

This project continues our effort to improve the U/VUV sensitivity of CMOS image sensors by coating the arrays with quantum dots (QD). This year's work will proceed with detailed testing of the devices that are now routinely coated with QD. In order for Thermo Fisher to proceed with the plans for commercialization, two key measurements are required. These tests are: (a) radiation testing of the CMOS and (b) deep UV/VUV absolute sensitivity measurements. If these two tests are positive, these devices would see widespread application in the markets served by Thermo Fisher Scientific, namely UV/VUV spectroscopy and radiation hard applications. We will be conducting the two tests at the NIST SURF III Cyclotron Facility in Gaithersburg, Md., and the 88-inch Cyclotron at Lawrence Berkeley National Laboratory in California.

Distributed-Cloud Computing to Support Computationally Complex Bio-Applications
Wendi Heinzelman
University of Rochester
UCB Pharma

Cloud computing provides an approach to accessing shared computing resources. In this project, we explore the use of a distributed mobile cloud (GEMCloud) that utilizes the idle computing power of readily available smart phones as the computing resources, providing an energy-efficient cloud. In GEMCloud, profiling can help with optimizing the distribution of jobs to available resources. Our goals in this research are: 1) complete the implementation of GEMCloud on real devices; 2) run large-scale tests of GEMCloud using a volunteer-based study; 3) develop scheduling algorithms to distribute jobs to available computing resources based on profiling data; and 4) analyze the performance of different scheduling approaches, including the use of redundancy.

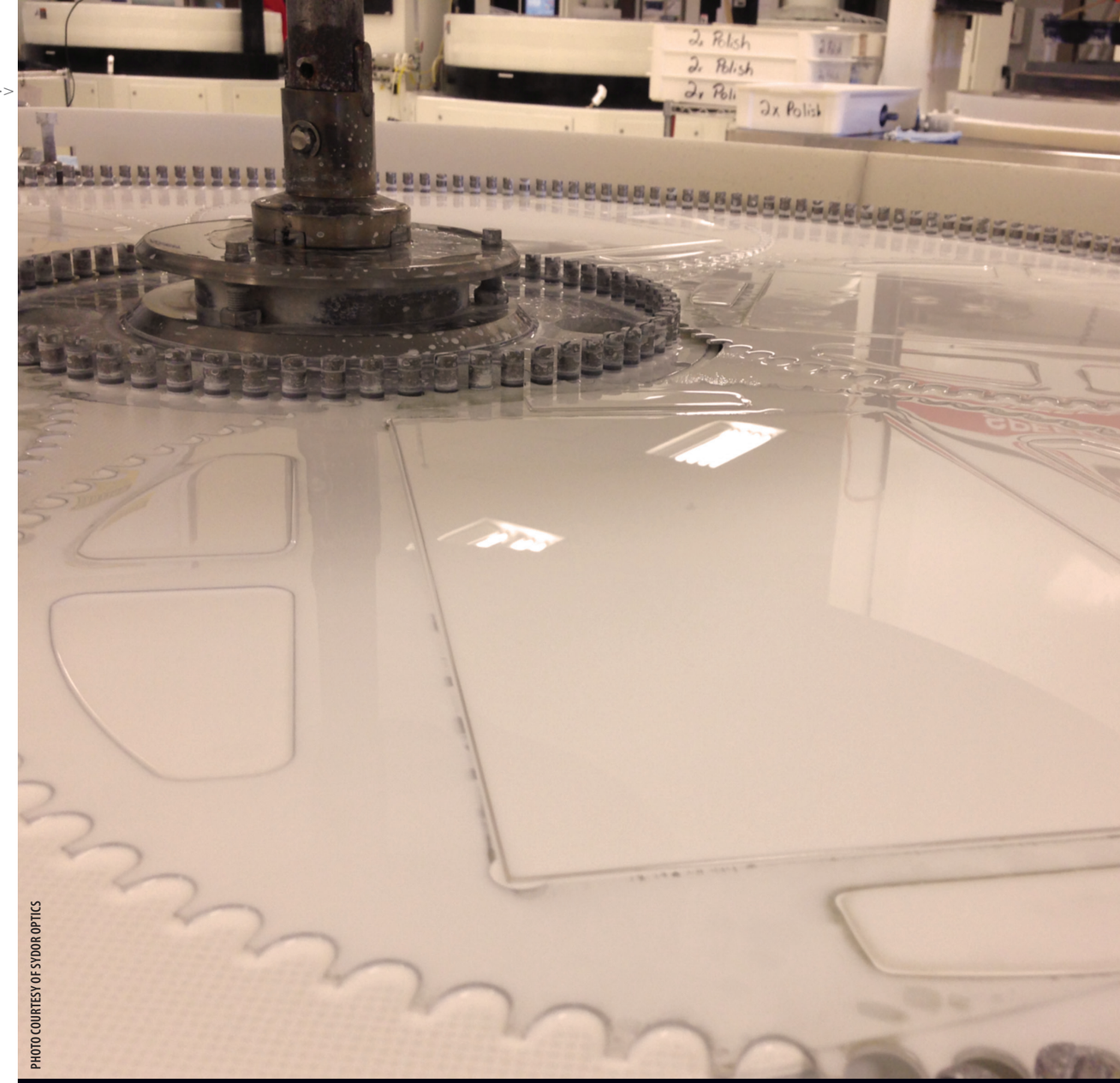


PHOTO COURTESY OF SYDOR OPTICS

CORPORATE PARTNERS

ADARZA BIOSYSTEMS
www.adarzabio.com

Adarza BioSystems, Inc. is an early-stage medical diagnostics company developing a rapid and label-free biological assay platform for measuring clinical and point-of-care (POC) samples. In addition to performing sophisticated clinical tests within minutes, this technology is fully arrayable, potentially allowing hundreds of tests to be run simultaneously on a single chip. Adarza's proprietary chip-based platform, Arrayed Imaging Reflectometry (AIR), achieves high sensitivity by detecting intensity changes in images of antireflective chips functionalized with highly specified detection molecules (proteins, DNA, etc.).

ADVANCED ACOUSTIC IMAGING TECHNOLOGIES, LLC

Advanced Acoustic Imaging Technologies, LLC (AAIT), is a private company located in Rochester, N.Y. AAIT has developed a revolutionary low-cost imaging technology that can be used for screening and diagnostics of soft tissue cancers. This new imaging methodology takes C-scan images in the coronal plane of the prostate gland in real time based on the photoacoustic phenomenon. It can give doctors a more accurate way to distinguish tumors than current ultrasound imaging methods.

ADVANTAGED IMAGING SYSTEMS, INC.
www.advis-inc.com

ADVIS is a fabless semiconductor of electronic image sensors and camera modules for applications that span the nearly $6 billion image sensor market. ADVIS applies its innovation technologies to the security and surveillance camera markets and is expected to expand its technologies for additional products such as single-use digital cameras, camera phones, and automotive applications.

ALCHLIGHT

AlchLight focuses on technological development and commercialization in the areas of laser engineering, materials processing, device cooling, energy harnessing, and biomedical applications.

BAUSCH + LOMB
www.bausch.com

Bausch + Lomb offers one of the world's most comprehensive portfolios of eye health products. B+L markets five broad categories of products: contact lenses, lens care, pharmaceuticals, cataract and vitreoretinal surgery, and refractive surgery. Because of mutual strengths in imaging sciences, the partnerships between B+L, various University of Rochester departments, and CEIS have helped to move research from the earliest stages to commercial development and clinical applications on a global scale.

CALIBER ID
www.caliberid.com

New York State–based Caliber Imaging & Diagnostics (formerly Lucid, Inc.) is a medical technologies company that designs, develops, and markets innovative imaging solutions that show tissue at the cellular level. Caliber Imaging & Diagnostics, Inc. is currently the only company in the world to offer in vivo confocal microscopes designed specifically for imaging skin and other tissue. Caliber I.D.'s Rapid Cell ID technology enables scientists and physicians to characterize intact normal and abnormal cellular architecture that is otherwise invisible to the naked eye.

CORNING, INC.
www.corning.com

Corning, Inc. is a diversified technology company that develops breakthrough technologies that significantly improve people's lives. Corning pursues innovation and focuses on high-impact growth opportunities in the telecommunications, flat panel display, environmental, life sciences, and semiconductor industries.

DIFFINITY GENOMICS
www.diffinitygenomics.com

Diffinity Genomics is a western New York life science start-up company with technologies that enable the development of high-margin, single-use disposable products for medical, industrial, and research applications in two very large and rapidly growing markets: DNA extraction and purifications and molecular diagnostics. The company is currently manufacturing and selling its first product, the Diffinity RapidTip for PCR Purification, to a very receptive market.

EXELIS
www.exelisinc.com

Exelis is a global supplier of innovative night vision, remote sensing, and navigation solutions that provide sight and situational awareness at the space, airborne, ground, and soldier levels. Our integrated solutions capture, intensify, compress, encrypt, transmit, combine, analyze, and deliver data. Exelis serves international and domestic commercial and government customers in the Department of Defense, intelligence, earth and space science, and commercial aerospace arenas with one of the widest ranges of capabilities in the image intensification and capture, remote sensing, and navigation industry.

FLINT CREEK RESOURCES
www.flintcr.com

Flint Creek Resources is a unique company that offers services to make used rare earth and zirconia glass polishing compounds better than new. Spent polishing compounds are processed through a proprietary system that removes glass, polishing pad fragments, and contamination from the slurry. The resulting clean polishing particles are then custom formulated to produce excellent stock removal, surface finish, suspension, and cleanability.

FLUXDATA, INC.
www.fluxdata.com

FluxData develops and manufactures multispectral and polarimetric imaging systems for aerospace, defense, industrial, medical, and scientific markets. FluxData is a privately held, women-owned company located in Rochester, N.Y. FluxData's imaging and system integration expertise helps guide customers from camera specification to delivery of the final system. Our staff of imaging experts work with customers to frame problems and deliver optimized systems based on a broad suite of options. Every product comes with FluxData's commitment to first-rate customer support.

GE GLOBAL RESEARCH
http://ge.geglobalresearch.com/

GE Global Research is headquartered in Niskayuna, N.Y., and is one of the world's most diversified industrial research labs, providing innovative technology for all of GE's businesses. Global Research has been the cornerstone of GE technology for more than 100 years, developing breakthrough innovations in areas such as medical imaging, energy generation technology, jet engines, and lighting. GE Global Energy's diverse set of technology expertise ranges from electronics to chemistry, biosciences to computing, metallurgy to fluid mechanics, materials to imaging—and everything in between.

HARBEC
www.harbec.com

HARBEC's mission is to provide tightly toleranced prototypes, tooling, machined components, and quality injection molded parts in a sustainable manner with a social conscience. We provide superior customer service, satisfaction, and timely delivery of custom engineered solutions. We proudly foster an atmosphere of encouragement and respect for the health and prosperity of our customers, employees, and the global community.

HARRIS CORPORATION
www.harris.com

Harris is an international communications and information technology company serving government and commercial markets in more than 125 countries. The company has more than 14,000 employees—including 6,000 engineers and scientists—dedicated to the development of best-in-class *assured communications®* products, systems, and services. The company's operation divisions serve markets for government communications, RF communications, broadcast communications, and microwave communications.

ICARDIAC TECHNOLOGIES, INC.
www.icardiac.com

iCardiac Technologies, Inc., provides drug development companies worldwide with the complete range of core lab services. Its team of cardiac safety experts collective brings more than 100 years of cardiology, electrophysiology, drug development, regulatory, and academic experience. iCardiac team members are active contributors on several FDA working groups that are advancing the field of cardiac safety. iCardiac's core laboratory services include scientific and regulatory consultation, protocol development, and end-to-end project and data management.

INTEGRATED NANO-TECHNOLOGIES, LLC
www.integratednano.com

Integrated Nano-Technologies, LLC was founded on the idea that the fusion of molecular biology, chemistry, and microelectronics holds the potential for revolutionary technical advances. Through the confluence of these disciplines, INT is able to create self-assembled nanoscaled circuits. A simple on/off circuit forms the basis for the first product, a novel biosensor capable of detecting single molecules of a target substance. This sensor can be deployed in a variety of devices for use in biosecurity, clinical diagnostics, food safety, and tracking systems.

INTERNATIONAL BUSINESS MACHINES
www.ibm.com

IBM is an information technology company that also provides business, technology, and consulting services. The company's major operations comprise a Global Services segment, a Systems and Technology group, a Software segment, a Global Financing segment, and an Enterprise Investments segment. IBM's current research portfolio includes the integration of nanotechnology into various systems and devices as well as VLSI design studies.

INTRINSIQ MATERIALS
www.intrinsiqmaterials.com

Intrinsiq Materials manufactures highly functional electronics inks for use at room temperature, in air, enabling printed electronics today and into the future. Intrinsiq Materials, the nanotechnology leader in printable electronic inks, offers a variety of electronic ink, including screen-printable and inkjetable copper ink, a silicon ink jet, and a nickel ink jet. Intrinsiq utilizes a unique process in making nanomaterial-based ink that allows the ink to be used in a room-temperature environment on paper, plastics, metals, and more.

EASTMAN KODAK COMPANY
www.kodak.com

Kodak has transformed itself into a technology company focused on imaging for business. Today's Kodak provides world-class R&D based on Kodak's unique strengths in the materials, imaging, and deposition sciences; breakthrough products enabling customers to achieve transformational improvements in quality, productivity, and sustainability; a broad solution set across graphic communications, product goods packaging, functional printing enabling, and software and professional services businesses use to redefine information flow and security.

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LIGHTOPTECH
www.lightoptech.com

LighTopTech Corp. is a women-owned business based in Rochester, N.Y. LighTopTech, an optical technology company, was founded in 2013. Our goal is to build innovative optical instruments to improve noninvasive imaging in medical and manufacturing fields.

MICROPEN TECHNOLOGIES
www.micropen.com

MicroPen Technologies is a design, development, and manufacturing resource and partner to electronics companies and medical device companies in the specialized technology of applying functional materials to surfaces.

MOOG-ISP
www.moog.com

Moog-ISP, formerly AMPAC In-Space Propulsion (ISP), is a leading developer and supplier of liquid rocket engines, tanks, and propulsion systems for commercial, defense, and spacecraft launch vehicles. Our leading position and reputation for quality, reliability, and value pricing is derived directly from our more than 60-year heritage and commitment to innovation for the future. Through ongoing R&D activities and corporate initiatives, our experienced team of scientists and engineers is developing higher performance engines and innovative propulsion systems. We use lean manufacturing practices to ensure continued affordability, high performance, and high-value products.

OMNI-ID
www.omni-id.com

Omni-ID is the leading supplier of passive low-profile UHF RFID tags. The company is focused on delivering affordable high-performance tags that work reliably in harsh environments, including on, off, and near metals and liquids. Omni-ID technology enables near-perfect accuracy in RFID asset tracking.

OPTIPRO SYSTEMS, LLC
www.optipro.com

OptiPro was founded on one revolutionary, yet simple, concept: optical fabricators deserve more. In the past 30 years, since we introduced the first affordable CNC machine designed specifically for the optics industry, we have consistently built a culture that cares—a culture of employees who live and breathe by our strong OptiPro values and a culture of best-in-breed customers who are collectively on a relentless pursuit of process efficiencies, design improvements, capability enhancements, and marketplace superiority.

ORTHO CLINICAL DIAGNOSTICS
www.orthoclinical.com/en-us/Pages/Home.aspx

Ortho Clinical Diagnostics serves the transfusion medicine community and laboratories around the world. We're a leading provider of total solutions for screening, diagnosing, monitoring, and confirming diseases early, before they put lives at risk. Headquartered in Raritan, N.J., with manufacturing operations in Rochester, N.Y.; Pompano Beach, Fla.; and Cardiff, Wales, Ortho Clinical Diagnostics has more than 2,500 employees worldwide. We are dedicated to investing significant resources to continuously improve our products and develop solutions to address unmet medical needs. Our single focus is to help hospitals, laboratories, and blood centers worldwide deliver results that help patients experience a better quality of life.

PHILIPS ELECTRONICS NORTH AMERICA
www.usa.philips.com

Philips Electronics North America Corporation manufactures and markets consumer electronics, domestic appliances, and personal care products and lighting and medical equipment. The company's products include televisions, audio and video players, home theaters, shavers, electric toothbrushes, remote controls, and webcams. It also provides bulbs, lamps, x-ray and ultrasound devices, and silicon systems. The company is based in Andover, Mass., with an additional office in New York. Philips Electronics North America Corporation operates as a subsidiary of Koninklijke Philips Electronics NV.

PL E-COMMUNICATIONS, LLC
www.ple-communications.com

Founded in 1999 and headquartered in Rochester, N.Y., P & L E-Communications LLC is a privately held, woman-owned small business (WOSB) that focuses on surveillance products powered by their proprietary AVT234© video motion detection (VMD) software engine that are integrated into military and energy sector security systems. PLE has formed strategic partnerships with high-end camera manufacturers and security systems integrators in addition to typical sales channels to multiply their market reach with their rack appliance, mobile security trailer, and deployable perimeter security kit.

POSITIVE SCIENCE, LLC
www.positivescience.com

Positive Science is a research and development company specializing in the design and construction of lightweight eye-tracking systems for mobile and wearable applications. Since 2002, PSLLC has developed lightweight eye tracking headgear and custom software for universities and research labs across the globe.

RT & I

Robotic Therapeutic and Imaging, LLC (RT&I) is developing the HemoStopBot medical device that performs precise robotic targeting of High-Intensity Focused Ultrasound (HIFU) for cardiac catheterizations performed with femoral artery puncture and for liver and kidney surfaces during biopsy. This device must work in conjunction with ultrasound medical devices that perform biopsies.

SEMROCK
www.semrock.com

Semrock was founded in 2000 based on a critical breakthrough in ion-beam sputtering technology that allowed the use of hard dielectric coatings on a single glass substrate. Since that time, more than half a million thin-film interference filters have been sold, and we remain at the forefront of optical filter technology for biotech and analytical instrumentation applications. We offer the most spectrally sophisticated optical filters on the market to drive significant improvements for our customers and their applications, like faster measurement times, reduced downtime, repeatable manufacturing, and lower optical component count. Semrock supports the biotech and analytical instrumentation market with three product platforms—optical filters for fluorescence instrumentation and microscopy, Raman instrumentation filters, and laser analytical instrumentation filters.

SIMPORE, INC.
www.simpore.com

SiMPore is a Rochester, N.Y.–based nanotechnology company that designs and produces membranes and membrane-enabled products based on its unique patent-pending platform technology—the NanoBarrier™ ultrathin nanoporous silicon membrane. The NanoBarrier™ membrane is the world's first membrane to offer both tunable nanometer-scale thickness and pore size. SiMPore is developing products that take advantage of these one-of-a-kind features, including filters for separating and concentrating biological molecules and nanoparticles, cell culture substrates for growing cells, and electron microscopy grids for preparing and imaging samples at the nanoscale.

SYDOR OPTICS
www.sydor.com

Sydor Optics specializes in the fabrication of precision-quality, flat-surfaced, parallel and wedged optics. We focus exclusively on the manufacture of flat optics- or "plano"-surfaced optics such as windows, glass wafers, wedges, mirrors, flat optics, and colored glass filters.

THERMO FISHER SCIENTIFIC INC.
www.thermofisher.com

Thermo Fisher Scientific Inc. (NYSE: TMO) is the world leader in serving science, with revenues of $17 billion and 50,000 employees in 50 countries. Our mission is to enable our customers to make the world healthier, cleaner, and safer. We help our customers accelerate life sciences research, solve complex analytical challenges, improve patient diagnostics, and increase laboratory productivity. Through our four premier brands—Thermo Scientific, Life Technologies, Fisher Scientific, and Unity Lab Services—we offer an unmatched combination of innovative technologies, purchasing convenience, and comprehensive support.

UCB PHARMA
www.ucb.com

At UCB our sense of purpose is to help people suffering from severe central nervous system or immunological disorders lead normal, everyday lives. Our ambition is to offer them innovative new medicines and groundbreaking solutions that go beyond the drug. We are committed to enabling cutting-edge scientific research that is driven by the patients' needs. UCB is a global biopharma company with a team of more than 8,000 talented employees, a strong market presence in about 40 countries.

URNANO

The Integrated Nanosystems Center consists of a 1,000 square-foot metrology (measurement) facility and a 2,000 square-foot cleanroom fabrication facility. The cleanroom lab was designed and equipped in a way that ensures it is virtually free of dust, foreign particles, and chemical vapors.

WEGMANS FOOD MARKET

www.wegmans.com

Wegmans Food Markets, Inc. is a family-owned U.S. regional supermarket chain headquartered in Gates, N.Y. Wegmans has 83 stores in the mid-Atlantic region—in New York, Pennsylvania, New Jersey, Maryland, Massachusetts, and Virginia. Founded in 1916 in Rochester, Wegmans has appeared on *Fortune* magazine's annual "100 Best Companies to Work For" list since its inception in 1998 and has ranked among the top 10 for eight consecutive years.

XEROX CORPORATION

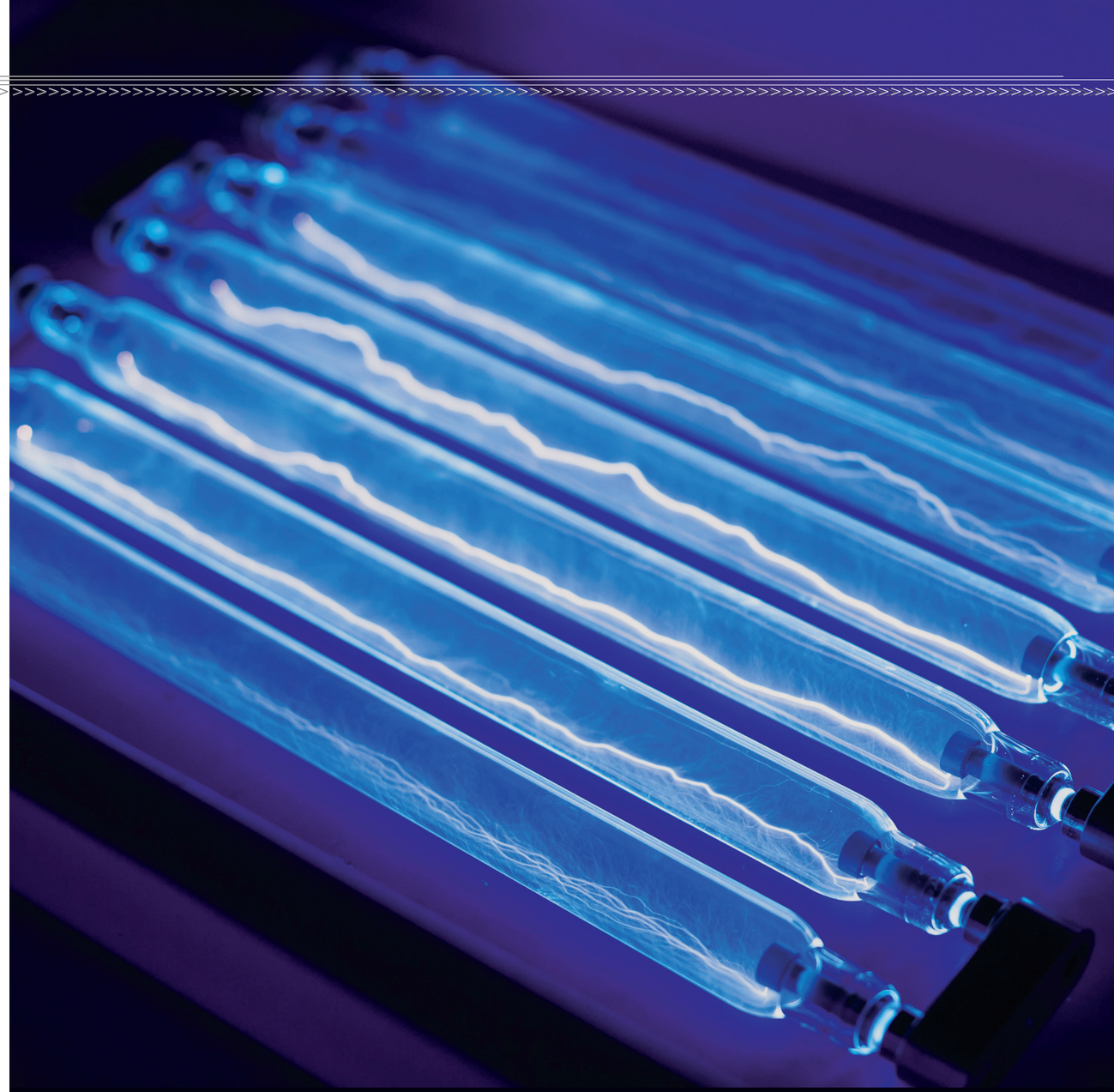
www.xerox.com

For more than a half a century, Xerox has been a leader in document technology and services. We continue to build on this heritage of innovation. We now are the world's leading enterprise for business process and document management, offering global services from claims reimbursement and automated toll transaction to customer care centers and HR benefits management. The new Xerox is dedicated to innovation, service, and giving our customers the freedom to focus on what matters most: your real business.

ZOMEGA TERAHERTZ CORPORATION

www.zomega-terahertz.com

Zomega Terahertz Corporation is focused on developing and deploying Terahertz-based technology solutions for both the public and private sector. We produce both pre-designed and custom systems for time-domain spectroscopy, inspection, and nondestructive testing and CW applications in both point measurement and imaging modalities, with true turnkey operation and integration into larger systems requiring THz capabilities. In addition, we collaborate with different research groups to push the frontiers of Terahertz science and commercialize new technologies.



FACULTY RESEARCHERS

Miguel Alonso

Associate Professor of Optics in the Institute of Optics, University of Rochester

Education

PhD, The Institute of Optics, University of Rochester Optics, 1996

MS, Universidad Autonoma Metropolitana Physics, 1990

Research Interests

- Propagation of waves
- Connection between rays and waves
- Integral transforms
- Phase space representations
- Uncertainty relations

Recent Research Projects

- Building accurate estimates of wave fields propagating based on ray information alone

(585) 275-7227 | www.optics.rochester.edu/people/faculty/alonso_miguel/index.html | alonso@optics.rochester.edu

James V. Aquavella

Professor of Ophthalmology, University of Rochester

Education

MD, University of Naples School of Medicine, 1957

BA, Johns Hopkins University, 1952

Research Interests

- Corneal wound healing
- Ocular surface imaging
- Karatoprosthesis

Recent Research Projects

- Various Ocular Surface Imaging project

(585) 273-3937 | www.urmc.rochester.edu/eye-institute/index.cfm | James_Aquavella@urmc.rochester.edu

Mark Bocko

Professor of Electrical and Computer Engineering and of Physics and Professor of Music Theory at the Eastman School of Music, University of Rochester

Education

PhD, University of Rochester Physics, 1984

MS, University of Rochester Physics and Astronomy, 1980

BS, Colgate University Physics and Astronomy, 1978

Research Interests

- Imaging microelectronics
- Wireless sensors
- Multimedia signal processing

Recent Research Projects

- Digital audio watermarking and steganography
- Image sensors with built-in image compression
- Digital CMOS image sensor read-out circuits

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Thomas G. Brown

Professor of Optics and Director, Robert E. Hopkins Center for Optical Design and Engineering, University of Rochester

Education

PhD, University of Rochester Optics, 1987

BS, Gordon College Physics, 1979

Research Interests

- Optical polarization and metrology
- Optoelectronic modeling Integrated optoelectronics

Recent Research Projects

- Enhancing image contrast using polarization correlations
- Stress engineering for polarimetry and imaging
- Polarization control of optical nanostructures
- Nonlinear properties of microstructured optical fibers

(585) 275-7816 | www.optics.rochester.edu/people/faculty_students_staff/faculty/brown.html | brown@optics.rochester.edu

Robert Clark

Dean of the Edmund A. Hajim School of Engineering and Applied Sciences, University of Rochester

Education

PhD, Virginia Polytechnic Institute Mechanical Engineering, 1992

MS, Virginia Polytechnic Institute Mechanical Engineering, 1988

BS, Virginia Polytechnic Institute Mechanical Engineering, 1987

Research Interests

- Science of acoustics
- Bionanomanufacturing

Recent Research Projects

- Development of new instruments for the exploration of single-molecule mechanics and for the deposition and control of materials at the nanoscale

(585) 275-4151 | www.hajim.rochester.edu/dean.html | robert.clark@rochester.edu

Jean-Philippe Couderc

Assistant Professor of Medicine, Department of Cardiology, University of Rochester

Education

PhD, National Institute of Applied Science (France) Biomedical Engineering, 1997

MBA, Simon Business School, Healthcare Management, 2003

MS, Medical Specialties Non-Medical School (France), 1994

Research Interests

- Computational science and engineering
- Numerical analysis
- Applications of computer science in electrophysiological signaling stabilization
- Refractometry
- Flexure systems
- Stage metrology

Recent Research Projects

- Non-contact video-based detector of cardiac arrhythmias

(585) 275-1096 | www.urmc.rochester.edu/people/22239419-jean-phillippe-couderc | jean-philippe.couderc@heart.rochester.edu

Jonathan D. Ellis

Assistant Professor of Optics and of Mechanical Engineering, University of Rochester

Education

PhD, Delft University of Technology (The Netherlands) Mechanical Engineering, 2010

MSc, BS, University of North Carolina at Charlotte Mechanical Engineering

Research Interests

- Linear displacement interferometry
- High power gas laser frequency stabilization
- Refractometry
- Flexure systems
- Stage metrology

Recent Research Projects

- Designing and developing smart optical sensors for compact, remote displacement sensing and for multi-DOF interferometry

(585) 275-4950 | www.me.rochester.edu/projects/jdellis-lab/ellis.html | j.d.ellis@rochester.edu

James Ferwerda

Associate Professor in the Munsell Color Science Laboratory and in the Center for Imaging Science, Rochester Institute of Technology

Education

PhD, Cornell University Experimental Psychology, 1998

MS, Cornell University Computer Graphics, 1987

BA, Cornell University Psychology with Honors, 1980

Research Interests

- Computer graphics
- Digital imaging
- Data visualization
- Visual perception
- Low vision
- Assistive technologies

Recent Research Projects

- Effects of image dynamic range on apparent surface gloss

(585) 475-4923 | www.cis.rit.edu/jaf | jaf@cis.rit.edu

Paul Funkenbusch

Professor of Mechanical Engineering, Professor of Materials Science, University of Rochester

Education
PhD, Michigan Technology University, 1984

Research Interests
- Relationships among microstructure, properties, and processing of materials

Recent Research Projects
- Optical Probing for Freeform Optics Metrology

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Thomas Gaborski

Assistant Professor, Rochester Institute of Technology

Education
PhD, University of Rochester Biomedical Engineering, 2008

MS, University of Rochester, Biomedical Engineering, 2004

BS, Cornell University Biological and Environmental Engineering, 2002

Research Interests
- Nanomaterials and membrane fabrication
- Microfluidics, separations, and device design
- Cellular biophysics
- Quantitative fluorescence imaging

Recent Research Projects
- Cellular co-culture screening assays

(585) 475-4117 | http://thomasgaborski.com/ trgbme@rit.edu

Greg T. Gdowski

Associate Professor of Biomedical Engineering and Executive Director Center for Medical Technology and Innovation, University of Rochester

Education
PhD, Boston University, 1996

Research Interests
- Vestibule-collic reflexes (VCR)

Recent Research Projects
- Balloon catheter testing platform for evaluating radio frequency ablation

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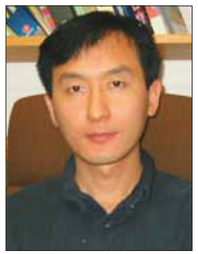

Chunlei Guo

Professor of Optics, Institute of Optics, University of Rochester

Education
PhD, Physics, University of Connecticut, 1999

BS, Physics, Changchun Institute of Optics and Fine Mechanics, 1994

Research Interests
- Femtosecond Laser-Matter Interactions at High Intensities

Recent Research Projects
- Superwicking cooling devices for computer CPU and microelectronics

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Wendi B. Heinzelman

Associate Professor of Electrical and Computer Engineering and Dean of Graduate Studies for Arts, Sciences & Engineering, University of Rochester

Education
PhD, Massachusetts Institute of Technology, Electrical Engineering and Computer Science, 2000

MS, Massachusetts Institute of Technology, Electrical Engineering and Computer Science, 1997

BS, Cornell University Electrical Engineering, 1995

Research Interests
- Multimedia communication
- Wireless sensor networks
- RFID systems
- Cloud computing
- Heterogeneous networking

Recent Research Projects
- Developing RFID systems for inventory management
- Designing a QoS-aware protocol architecture to support real-time multimedia data transmission
- Optimizing video-based sensor networks

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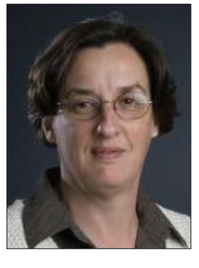

Maria Helguera

Associate Professor, Imaging Science, Rochester Institute of Technology

Education
PhD Imaging Science, Rochester Institute of Technology, 1999

MS Electrical Engineering, University of Rochester, 1988

BS Physics, Universidad Nacional Autónoma de México, 1984

Research Interests
- Medical imaging system characterization
- Ultrasound tissue characterization
- Non-destructive evaluation techniques
- Digital image processing

Recent Research Project
- Designing an image processing toolkit to view through light scattering materials

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Karl D. Hirschman

Professor of Micron Technology of Microelectronic Engineering, Rochester Institute of Technology

Education
PhD, University of Rochester Electrical and Computer Engineering, 2000

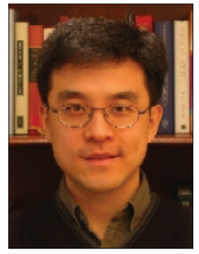
MS, Rochester Institute of Technology, Electrical Engineering, 1992

BS, Rochester Institute of Technology, Microelectronic Engineering, 1990

Research Interests
- Silicon device integration on nontraditional substrates
- Metal-oxide semiconductors for thin-film electronics
- Silicon-based optoelectronics

Recent Research Projects
- Development and characterization of high-performance transistors on glass (Corning, Inc. and NYSTAR/CEIS)
- Development of bipolar and MOS high-power microwave transistors (Spectrum, Devices Corporation, Hatfield, Pa.)

(585) 475-5130 | www.microe.rit.edu/hirschman.html | kdhemc@rit.edu



Michael Huang

Associate Professor of Electrical and Computer Engineering, University of Rochester

Education
PhD, University of Illinois at Urbana-Champaign Computer Science, 2002

MS, University of Illinois at Urbana-Champaign Computer Science, 1999

BS, Tsinghua University Computer Engineering (Beijing), 1994

Research Interests
- Processor microarchitecture
- Communication and memory substrate, reliability
- Energy-efficient and complexity-effective design
- Emerging issues and new capabilities of high-performance computer architecture

Recent Research Projects
- Non-contact video-based detector of cardiac arrhythmias

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Krystel R. Huxlin

Associate Professor of Ophthalmology, University of Rochester

Education
PhD, University of Sydney
Neuroscience, 1994

BS (Med), University of Sydney
Neuroscience, 1991

Research Interests
- Optics of the eye
- Femtosecond laser micro-machining in cornea and lens
- Visual perception and psychophysics
- Biomedical imaging

Recent Research Projects
- Femtosecond laser micromachining
- Effect of corneal wound healing on physiological optics of the eye
- Perceptual learning with a damaged visual system

(585) 275-5495 | www.urmc.rochester.edu/eye-institute/research/labs/huxlin-lab.cfm | huxlin@cvs.rochester.edu

Zeljko Ignjatovic

Associate Professor, Electrical and Computer Engineering, University of Rochester

Education
PhD, University of Rochester
Electrical and Computer Engineering, 2004

MS, University of Rochester
Electrical and Computer Engineering, 2001

BS, University of Novi Sad
Electrical Engineering and Computer Science, 1999

Research Interests
- A/D conversion
- CMOS analog circuits
- Low power circuit architectures
- Image sensors

Recent Research Projects
- Developing and investigating focal plane compression techniques where majority of multiplication computations required by the compression are rendered unnecessary

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Stephen Jacobs

Professor of Optics and Chemical Engineering and Senior Scientist, Laboratory for Laser Energetics, University of Rochester

Education
PhD, University of Rochester
Optics, 1976

BS, University of Rochester
Optics (High Distinction), 1970

Research Interests
- Novel optical finishing process
- Mechanisms of Magnetorheological Finishing (MRF)
- Liquid crystals
- High peak power laser system with large aperture LC polarizers and wave plates

Recent Research Projects
- Polymer cholesteric liquid crystal flakes for active e-o applications such as electronic paper

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Wayne H. Knox

Professor of Optics and of Physics, Professor of Visual Sciences, and Associate Dean of Education and New Initiatives for the Hajim School of Engineering & Applied Sciences, University of Rochester

Education
PhD, University of Rochester
Institute of Optics, 1983

BS, University of Rochester
Institute of Optics, 1979

Research Interests
- Ultrafast laser physics and prototyping
- Ultra-broadband laser systems
- Biomedical optics using novel ultrafast lasers
- Femtosecond micromachining of polymers
- Nonlinear fiber and semiconductor devices

Recent Research Projects
- Femtosecond micromachining of ophthalmic polymers

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John Lambropoulos

Professor of Mechanical Engineering and of Materials Science, Director of Materials Science Program, and Senior Scientist in Laboratory for Laser Energetics, University of Rochester

Education
PhD, Harvard University Mechanical Engineering, 1984

MS, Harvard University Applied Sciences and Mechanical Engineering, 1981

BS, Brown University Applied Mechanics, 1980

Research Interests
- Describing macroscopic behavior of solids by examining underlying microstructural features
- Mechanical, electrical, and/or optical affects to response of homogenous or heterogeneous materials

Recent Research Projects
- Optimization of optics manufacturing techniques such as deterministic microgrinding, loose abrasive lapping, Magneto-rheological Finishing (MRF), and loose abrasive finishing of optical glasses and ceramics

(585) 275-4070 | www.me.rochester.edu/people/faculty/lambropoulos_john/ | john.lambropoulos@rochester.edu

Jiebo Luo

Professor of Computer Science, University of Rochester

Education
PhD, University of Rochester
Electrical Engineering, 1995

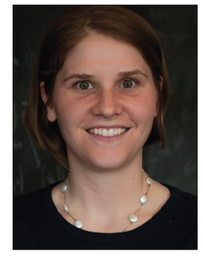
MS, University of Science and Technology (China) Electrical Engineering, 1992

BS, University of Science and Technology (China) Electrical Engineering, 1989

Research Interests
- Computer vision
- Machine learning
- Social media data mining
- Human computer interaction
- Biomedical informatics
- Mobile and pervasive computing
- Computational photography

Recent Research Projects
- Fine-grained user profiling from multiple social multimedia platforms
- Wine recommendation for grocery shoppers

(585) 276-5784 | www.cs.rochester.edu/u/jluo/ | jluo@cs.rochester.edu



Kara Maki

Assistant Professor, School of Mathematical Science, Rochester Institute of Technology

Education
PhD, University of Delaware
Applied Mathematics, 2009

MS, University of Delaware Applied Mathematics, 2006

BS, University of New Hampshire
Mathematics, 2003

Research Interests
- Physical systems and industrial problems pertaining to flows of biological and complex fluids
- Modeling
- Ordinary and partial differential equations
- Scientific Computing

Recent Research Projects
- Affect of contact lens distortion on exchange of tears
- Model for suction pressure under a contact lens

(585) 475-2541 | www.people.rit.edu/klmsma/ | kmaki@rit.edu

James L. McGrath

Associate Professor of Biomedical Engineering, University of Rochester

Education
PhD, Massachusetts Institute of Technology Biological Engineering, 1998

MS, Massachusetts Institute of Technology Mechanical Engineering, 1994

BS, Arizona State University
Mechanical Engineering, 1991

Research Interests
- Nanoparticle and molecular separations
- Nanotechnology
- MEMS and micro fabrication
- Cell culture technologies

Recent Research Projects
- The interaction of nanoparticles with cells and protein mixtures
- Ultrathin silicon-based nanomembranes for filtration of molecules and nanoparticles
- Ultrathin silicon-based nanomembranes for biological co-cultures

(585) 273-5489 | www.bme.rochester.edu/bmeweb/faculty/mcgrath.html | james.mcgrath@rochester.edu

Benjamin Miller
Associate Professor, Dermatology, University of Rochester

Education
PhD, Organic Chemistry, Stanford University, 1994

BS, BA, Chemistry, Mathematics and German, Miami University, 1988

Research Interests
- Biomedical nanotechnology
- Combinatorial chemistry
- Biophysical methods
- Biosensors

Recent Research Projects
- The AIR Flu Chip: A Multiplex Optical Biosensor of Influenza Serology

(585) 275-9805 | www.urmc.rochester.edu/derm/faculty/bmillerRES.html | Benjamin_Miller@URMC.rochester.edu

Zoran Ninkov
Micron Technology Professor of Microelectronic Engineering, Rochester Institute of Technology

Education
PhD, University of British Columbia Astronomy, 1985

MS, Monash University Physical Chemistry, 1980

BS, University of Western Australia Physics, 1977

Research Interests
- Novel 2-D CMOS detector arrays
- Fundamental limitations of visible and IR arrays
- Miniaturized multispectral systems

Recent Research Projects
- Development of novel two-dimensional detector arrays
- Development of image processing techniques for optimal analysis of such two-dimensional astronomical image data

(585) 475-7195 | www.cis.rit.edu/people/faculty/ninkov/ | ninkov@cis.rit.edu

Kevin Parker
William F. May Professor of Engineering and Professor of Electrical and Computer Engineering, Biomedical, Engineering, and Radiology, University of Rochester

Education
PhD, Massachusetts Institute of Technology, 1981

MS, Electrical Engineering, Massachusetts Institute of Technology, 1978

BS, Engineering Science, SUNY Buffalo, 1976

Research Interests
- Imaging Processing
- Medical Imaging
- 3D/4D Image Synthesis
- Biomedical Imaging
- Ultrasound Imaging systems

Recent Research Projects
- Sonoelastography to Measure Intrahepatic Fat

(585) 275-3294 | www.ece.rochester.edu/people/faculty/parker_kevin/index.html | kevin.parker@rochester.edu

Richard Phipps
Dean's Professor of Environmental Medicine, Oncology, Pediatrics, and Microbiology and Immunology: Director, Lung Biology and Disease Program, University of Rochester

Education
PhD, Immunology, Medical College of Virginia, 1980

BS, Medical Technology, Loyola College, 1977

Research Interests
- Cellular and molecular characterization of fibroblasts
- Control of normal and malignant B lymphocyte activation

Recent Research Projects
- Ocular Surface Metrology and Inflammatory Mediator Response to Topical Administration of Anti-inflammatory Drug

(585) 275-8326 | https://www.urmc.rochester.edu/people/20191221-richard-paige-phipps/researchers
richard_phipps@urmc.rochester.edu

Judith L. Pipher
Professor Emeritus of Physics and Astronomy, University of Rochester

Education
PhD, Cornell University Astronomy, 1971

MS, Cornell University Astronomy, 1970

BS, University of Toronto Physics and Astronomy, 1962

Research Interests
- Infrared observations of star forming regions
- Infrared detector array development and applications to astronomy and to persistent surveillance

Recent Research Projects
- Teledyne HgCdTe 10 micron cutoff detector arrays for use in future space experiments, with particular emphasis on NEOCam (Near Earth Object Camera)
- Characterization of Raytheon long wavelength HgCdTe detector arrays
- FIRE spectrometer development
- Persistent surveillance-driven projects

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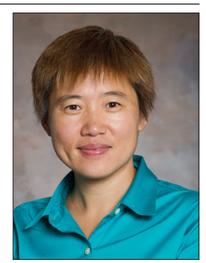

Jie Qiao
Associate Professor of Chester F. Carlson Center for Imaging Science, Rochester Institute of Technology

Education
PhD, University of Texas at Austin Electrical and Computer Engineering, 2001

MBA, Simon Business School, 2012

MS, Tsighua University (Beijing) Precision Instruments and Fine Mechanics, 1997

Research Interests
- Optical metrology
- Optical instrumentations
- Adaptive and active optics
- Segmented large-scale optics alignment and testing
- Pulse compression, ultrafast laser systems and applications
- Optical system design and performance evaluation

Recent Research Projects
- Development and investigation of an integrated laser-based optics polishing and manufacturing technology
- Laser polishing for additive manufacturing

(585) 475-5629 | www.rit.edu/cos/ | qiao@cis.rit.edu

Jannick Rolland
Brian J. Thompson Professor of Optical Engineering, Professor of Optics and Biomedical Engineering, Professor in the Center for Visual Science, University of Rochester

Education
PhD, University of Arizona Tucson Optical Science, 1990

MA, University of Arizona Tucson Optical Science, 1987

Diplôme Grandes Ecoles, Institut d'Optique (France), 1984

Research Interests
- Optical system design for imaging and non-imaging optics
- Physics-based modeling
- Image quality assessment

Recent Research Projects
- Gabor-domain optical coherence microscopy for detection of defects in manufacturing
- Optical coherence tomography for quantification of contact lens properties

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David Ross
Professor, Center for Applied and Computational Mathematics, Rochester Institute of Technology

Education
PhD, New York University Mathematics, 1985

BA, Colombia University Mathematics, 1980

Research Interests
- Statistical physics of protein mixtures
- Cell signaling dynamics
- Fluid mechanics and solid mechanics of contact lenses and tear film

Recent Research Projects
- Affect of contact lens distortion on exchange of tears
- Model of suction under contact lens

(585) 475-5275 | www.people.rit.edu/dsrsma/ | dsrsma@rit.edu

Lewis Rothberg

Professor of Chemistry, of Chemical Engineering, and of Physics, University of Rochester

Education
PhD, Harvard University Physics, 1984

BS, University of Rochester Physics, 1977

Research Interests
- Organic device science
- Metal nanoparticle enhanced spectroscopy and imaging
- Biomolecular sensing

Recent Research Projects
- Novel optical technologies for sensing of nucleic acids and proteins
- Mechanistic studies of electronic polymers used in luminescent devices
- Plasmonic enhancement of molecular absorption and luminescence

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Geunyoung Yoon

Associate Professor of Ophthalmology, of Optics in the Institute of Optics, and in the Center for Visual Science, University of Rochester

Education
PhD, Osaka University Laser Optics, 1998

MS, Osaka University Laser Optics, 1995

BS, SungKyunKwan University Physics, 1990

Research Interests
- Adaptive optics and in-vivo ocular surface and intraocular imaging
- Customized vision correction
- Presbyopic correction

Recent Research Projects
- Large stroke adaptive optics for correcting highly aberrated eyes
- Investigation of accommodation and presbyopic lenses (multifocal and accommodative intraocular lenses)

(585) 273-3998 | www.cvs.rochester.edu/yoonlab/yoon.htm | yoon@cvs.rochester.edu

James M. Zavislan

Associate Professor, Institute of Optics, of Dermatology and Biomedical Engineering, University of Rochester and Director, Center for Institute Ventures

Education
PhD, The Institute of Optics, University of Rochester, 1988

BS, The Institute of Optics, University of Rochester, 1981, High Honors

Research Interests
- Improving the performance of optical imaging systems
- Optical design
- Optical fabrication
- Optical design using anisotropic optical materials
- Tolerancing of optical systems

Recent Research Projects
- Multimodel tumor mapping systems
- Handheld Enhanced Reflectance Confocal Microscopy for Neuropathy Screening

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Xi-Cheng Zhang

Director of the Institute of Optics, M. Parker Givens Professor of Optics, University of Rochester

Education
PhD, Brown University RI Physics, 1986

MS, Brown University RI Physics

BS, Peking University, 1982

Research Interests
- Terahertz optics sensing
- Terahertz optics imaging

Recent Research Projects
- The generation, detection, and applications of free-space THz beams with ultrafast optics

(585) 275-0333 | www.optics.rochester.edu/people/faculty/zhang_xi-cheng/index.html | Xi-Cheng.Zhang@rochester.edu

CEIS STAFF

CEIS staff prides itself on its commitment to fostering industry-university partnerships that lead to economic development for our region.

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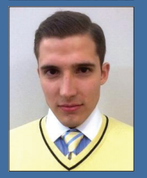

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CEIS ADVISORY BOARD

CEIS leadership meets with the advisory board to develop action-oriented plans to keep innovative technologies in the pipeline, connecting academic research with corporate product development.

CEIS acknowledges and applauds its advisory board members for their leadership, expertise, and forward-thinking ideas:

Bob Naum
EMF Corporation (chair)

Bob Fiete
Exelis

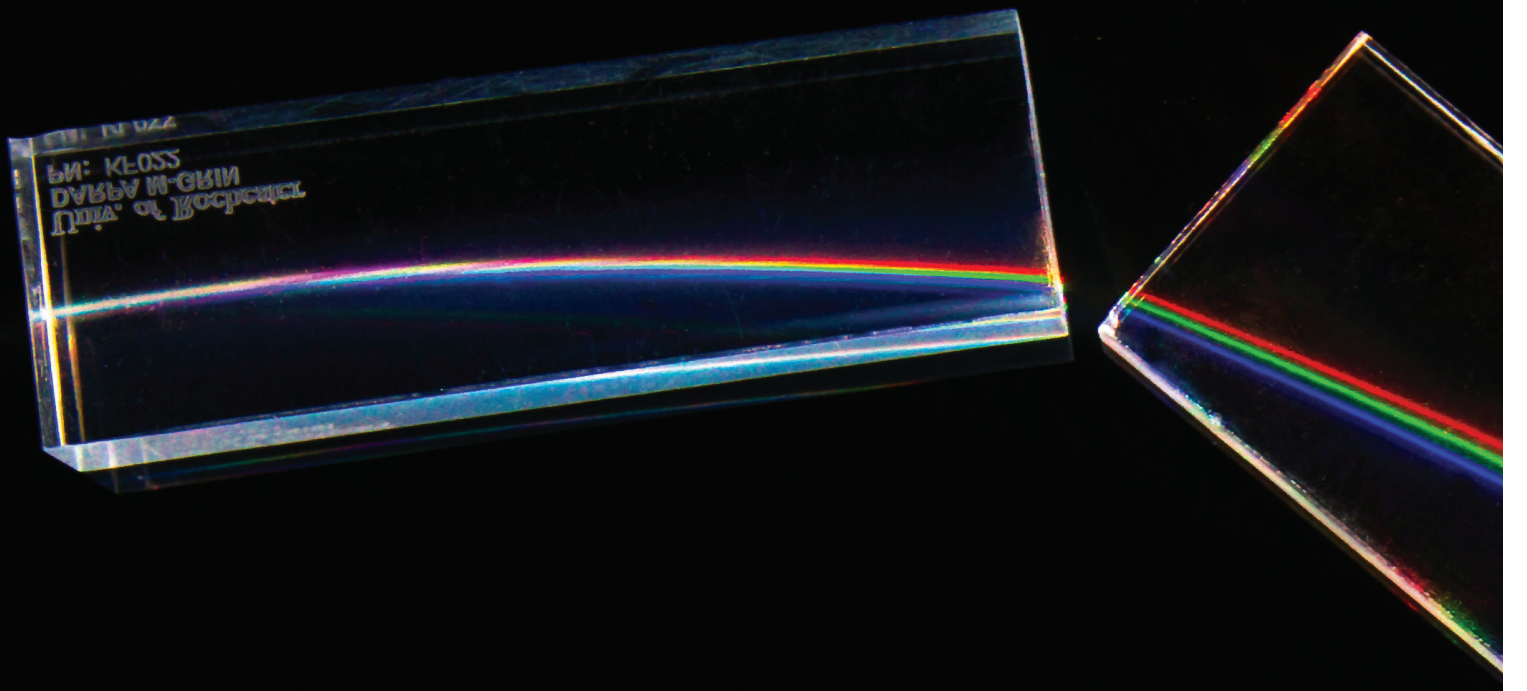
Zoran Ninkov
Rochester Institute of Technology

Ian Cox
Consultant

Julie Gerstenberger
Consultant

Mark S. Peterson
Greater Rochester Enterprise

Alan Evans
Corning, Inc.



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Nick Napolitan, and Ervis Vukaj

Cover photo: J. Adam Fenster, University of Rochester,
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